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The Milk River: International Lifeline of the Hi-Line

A Guidebook

Milk River International Alliance
Bureau of Reclamation, Montana Area Office
Montana Department of Natural Resources and Conservation

Photo: Airphoto -Jim Wark.

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About this Guidebook

From cold winters to hot summers, from strong thunderstorms to prolonged drought, from the Rocky Mountains to the high plains, from Canada to the United States, from small cities to scattered ranches—the Milk River Watershed has these and more. What is it about this watershed that makes folks want to call it home? What characteristics of the physical topography, history, water and land resources, and the lifestyles make this such a special place? The information here will help you answer these questions.

This guidebook was prepared under the direction of the Milk River International Alliance as an learning tool to accompany the video *The Milk River: International Lifeline of the Hi-Line.** The video was the first product of an information and education effort begun in 1998, and it was shown publicly at a Milk River Know Your Watershed Workshop in Havre in January 1999.** The Milk River International Alliance is a spin-off from this same Know Your Watershed Workshop. A primary goal of the Alliance is to provide educational opportunities to help residents make informed decisions regarding the future of the watershed. (For more about the Alliance see Chapter 9 page 30.) Together, the video and this guidebook provide an enduring information package to advance the Alliance's goal of providing an ongoing forum for education about the Milk River Watershed.

Compilation of a comprehensive book about the Milk River Watershed would take volumes. Of necessity, this guidebook's contents are limited—it takes a mere step towards expanding our knowledge of the watershed. Additional resources are identified at the end of each chapter for those who want to learn more.

So sit back. Relax. See if you can discover something new of interest. And enjoy your journey through Milk River country—a unique international watershed!

— Kristi Kline, Member of Milk River International Alliance
Brent Esplin, USDI Bureau of Reclamation

* *The Milk River: International Lifeline of the Hi-Line* video was made possible with support of the following organizations: Blackfeet Conservation District; Fort Belknap Tribes; Blaine, Hill, Phillips and Valley Conservation Districts; Alfalfa Valley, Fort Belknap, Glasgow, Harlem, Malta, Paradise Valley and Zurich Irrigation Districts; Environment Canada; E.P.A.; Alberta Environmental Protection; Montana Community Foundation; DEQ; FWP; DNRC; Montana Watercourse; North Central Montana Stockgrowers' Association; SaskWater; BOR; Walleyes Unlimited–Fresno Chapter.

** The video is available at conservation districts in Hill, Blaine, Phillips and Valley counties. See p. 41 for contact details.

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Acronyms Used in this Guide

BLM – Bureau of Land Management (U.S. Department of the Interior)
BOR – Bureau of Reclamation (U.S. Department of the Interior)
DNRC – Montana Department of Natural Resources and Conservation
EPA – Environmental Protection Agency
FEMA – Federal Emergency Management Agency
MCA – Montana Code Annotated
DEQ – Montana Department of Environmental Quality
FWP – Montana Department of Fish, Wildlife & Parks
MSU – Montana State University
NRCS – Natural Resources Conservation Service (U.S. Department of Agriculture)
USDA – U.S. Department of Agriculture
USDI – U.S. Department of the Interior
USGS – U.S. Geological Survey (U.S. Department of the Interior)
USFWS – U.S. Fish and Wildlife Service (U.S. Department of the Interior)

Common Measures

1 cfs (cubic foot per second) = 7.48 gallons/second
= 448.8 gallons/minute
= 40 miner's inches
= 646,272 gallons/day
= 1.98 acre-feet/day

1 acre-foot = volume of water that covers an acre to a depth of 1 foot
= 43,560 cubic feet
= 325,851 gallons
= supplies a family of 5 for 1 year

Glossary

Italicized items throughout the text are defined in the glossary at the end of this booklet.

Desolate? Forbidding? There was never a country that in its good moments was more beautiful....

Chapter 1

The Milk River Watershed

...Even in drought or dust storm or blizzard it is the reverse of monotonous, once you have submitted to it with all the senses. You don't get out of the wind, but learn to lean and squint against it. You don't escape sky and sun, but wear them in your eyeballs and on your back. You become acutely aware of yourself. The world is very large, the sky even larger, and you are very small.

--Wallace Stegner, Wolf Willow

Residents of Milk River, Alberta; Glasgow, Montana; the Rocky Boy's Indian Reservation; and Val Marie, Saskatchewan all have something in common. They live in the Milk River *Watershed.*

Watersheds can be very large or quite small. The Milk River Watershed is a long drainage, with tributaries originating in Glacier National Park, the Cypress Hills, the Bears Paw and Little Rocky Mountains, and the Sweetgrass Hills (see map pp. 22-23). Tributaries like Sage Creek or Battle Creek are smaller watersheds that 'nest' within the larger Milk River Watershed. Whether you have lived in the Milk River Watershed for a month or for a lifetime, there's something still to be learned about this special place. Let's explore the unique characteristics of the Milk River Basin.

Geography and Climate

From the headwaters of the Rocky Mountain Front near Glacier National Park, the Milk River Watershed (see map pp. 22-23) covers about 23,800 square miles in Montana, Alberta, and Saskatchewan. Of the total drainage area, 8,279 square miles lie in Canada and 15,521 square miles in Montana. The Milk River flows 700 miles from its headwaters to its mouth at the Missouri. Along its way, it crosses the international boundary twice—once as it moves northeast from the Blackfeet Reservation in Montana into Alberta and once again 216 miles downstream, where it turns south, reentering Montana. From this border crossing over the next 50 miles, the river follows an ancient Missouri River channel where it becomes Fresno Reservoir near Havre. From Fresno, the river turns east and travels many miles before joining the Missouri River below Ft. Peck Reservoir.

Thirty tributaries contribute to the Milk River. *Tributary* inflows are small in the narrow upper basin. In the broad lower portion, tributaries drain the Bears Paw and Little Rocky Mountains from the south, and several large tributaries flow from Alberta and Saskatchewan. Despite the expansive drainage, natural flows are often minimal, except for spring runoff or the infrequent rainstorm.

The climate of the Milk River Watershed is semiarid, characterized by moderately low rainfall, low humidity, hot summers, cold winters, and many sunny days. Precipitation varies dramatically from the mountains to the plains. The plains are relatively dry, with mean annual precipitation ranging from 10 to 14 inches. They receive most of their precipitation (6-7 inches) between April 1 and July 31, with lesser amounts (4-5 inches) falling between August 1 and March 31. The *island mountain ranges* are slightly wetter, averaging 14 to 25 inches. Mean annual precipitation is 20 to 40 inches in the headwaters mountain areas.

Summer temperatures range from 85°F in the highest elevations in the Bears Paw Mountains south of Havre, to 102°F at the lowest elevation in the watershed near Glasgow. In winter, arctic air masses can plunge temperatures to -35°F.

Elevation in the Milk River Watershed varies dramatically—from 9,553 feet to 2,035 feet. However, the average *gradient* on the Milk River is modest—1.5 feet per mile between Havre and Malta, and 1.0 foot per mile between Malta and its *confluence* with the Missouri River.

Photo by James R. Page, courtesy of Grasslands National Park of Canada.

Red Buttes, Grasslands National Park of Canada.

Geology

The ancient action of wind, water, *glaciers*, and *tectonics* shaped the *geomorphology* of the Milk River Watershed. The Missouri River once ran north from Virgelle to near Havre, where it flowed east into what is now the Milk River Valley. About 2.5 million years ago, climate changes caused formation of the 2,000-foot thick Keewatin ice sheet. The Keewatin Glacier pressed south from Canada, forcing the Missouri River to cut a new channel. Left behind was the Milk River, which now flows in the old Missouri River channel from near Havre to its mouth at the present-day Missouri.

Acting like a giant bulldozer, the glacial movement pushed a mixture of materials ranging from clay sized particles to boulders the size of a house. This material, known as *glacial till*, shaped most of the landforms in the watershed. The scraping and depositing action left mostly coarse and rocky soils, though sand, silt, and clay exist throughout the watershed. Generally, clay soils are found in the valley floors, with silts and sands in the uplands.

The ice age ended about 15,000 years ago causing the huge ice sheet to melt. Glacial melt-water transported large quantities of sand and gravel, depositing them into large flat areas known as *glacial outwash plains*. The Flaxville gravels near Turner, Montana north of Harlem are one example. The erosive forces of glacial outwash streams cut through the glacial till to form "coulees." In these deeply eroded drainages the Bearpaw Shale is sometimes exposed. This formation was shaped by an inland sea about 71,000,000 years ago.

In other areas, exposed layers of sandstone, siltstone and shale reveal the Judith River Formation. Here flood waters from the Milk and Missouri rivers spread out on the surrounding *floodplain* dropping sediments forming soils called *alluvium*. This alluvium is the irrigated portion of the Milk River Valley.

Mountainous areas in the watershed are important geological features. The Rocky Mountains, Little Rocky Mountains, Bears Paw Mountains, Sweet Grass Hills and Cypress Hills are collection areas for water, replenishing *surface water* and *aquifers*.

The Cypress Hills are comprised of *sedimentary rocks* and *conglomerates*, while the other three mountain ranges formed from volcanoes. The Rocky Mountain Uplift caused these mountain ranges to rise several thousand feet above the surrounding plains. The *bedrock* in these mountain ranges is much more resistant than the surrounding glacial till or Bearpaw Shale. Thousands of years of *erosion* has removed several thousand feet of the softer material, leaving the island mountain ranges relatively untouched, standing high above the surrounding prairie.

Why is the River Valley So Broad?

River valleys are classified by geologists as 'young,' 'middle age,' or 'mature.' Young valleys are 'V' shaped, lack wide floodplains and meanders, and few cottonwoods and willows grow there. Middle age valleys are 'U' shaped; tend to have small meanders, and some cottonwoods and willows. Mature or old age valleys are broad, flat bottomed, have many large meanders, and cottonwood and willow are common. As a general rule, the size of a river valley is determined by the size of its river. In Blaine and Phillips counties, the Milk River Valley is much larger and wider than could ever have been created by a river its size. What accounts, then, for the broad river valley in this area?

Answer: The ancient course of the Missouri River carved the broad valley occupied, today, by a considerably smaller Milk River.

A Cross-Section of the Milk River Watershed

This cross-section applies for the Milk River Watershed from Blaine County through Valley County. The Milk River Watershed from Glacier through Hill County is slightly different in that the channel is not cut as deep and the floodplain is not as broad, but the soils are similar.

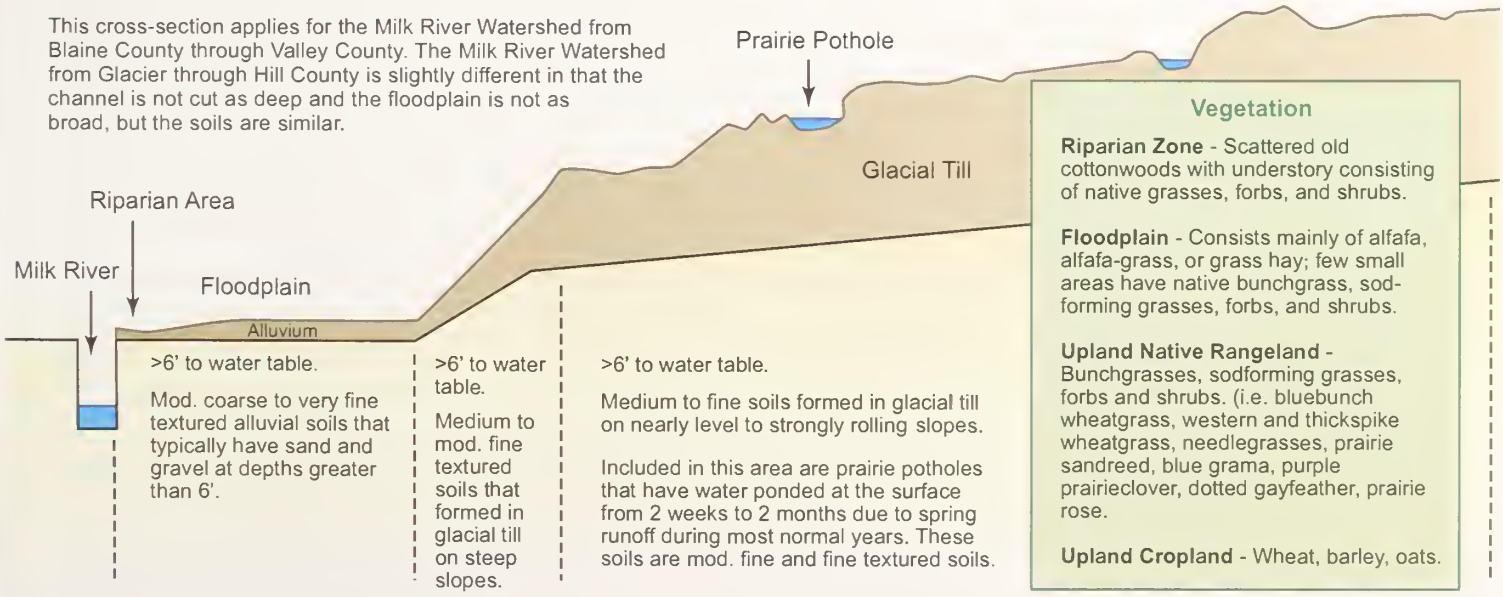
Prairie Pothole
Glacial Till
Riparian Area
Milk River
Floodplain
Alluvium
>6' to water table.
Mod. coarse to very fine textured alluvial soils that typically have sand and gravel at depths greater than 6'.
>6' to water table.
Medium to mod. fine textured soils that formed in glacial till on steep slopes.
>6' to water table.
Medium to fine soils formed in glacial till on nearly level to strongly rolling slopes.
Included in this area are prairie potholes that have water ponded at the surface from 2 weeks to 2 months due to spring runoff during most normal years. These soils are mod. fine and fine textured soils.
Vegetation
Riparian Zone - Scattered old cottonwoods with understory consisting of native grasses, forbs, and shrubs.
Floodplain - Consists mainly of alfafa, alfafa-grass, or grass hay; few small areas have native bunchgrass, sod-forming grasses, forbs, and shrubs.
Upland Native Rangeland - Bunchgrasses, sodforming grasses, forbs and shrubs. (i.e. bluebunch wheatgrass, western and thickspike wheatgrass, needlegrasses, prairie sandreed, blue grama, purple prairieclover, dotted gayfeather, prairie rose.
Upland Cropland - Wheat, barley, oats.

Diagram by Rick Bandy, USDA-NRCS.

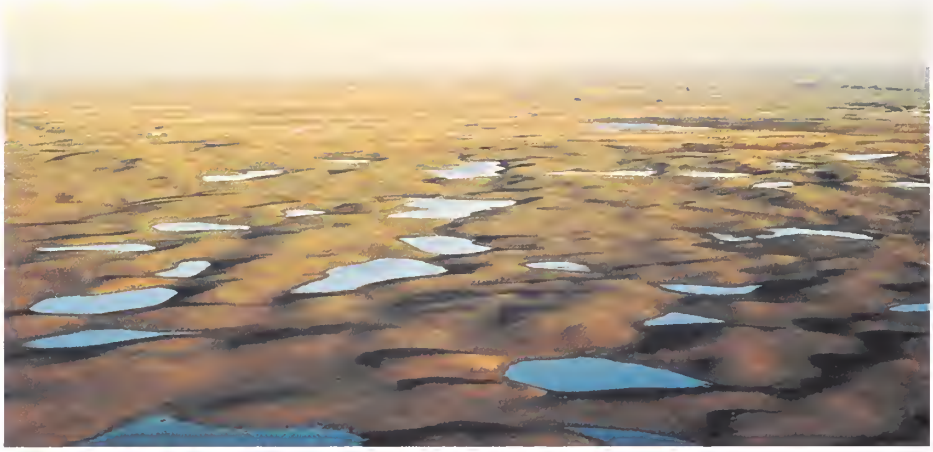

Photo by Jim Stutzman, USFWS.

Prairie potholes in northern Montana.

Of the total land area in the Milk River Watershed, rangeland is the most abundant land type (3,704,300 acres or approximately 50%). Rangeland, where the landscape has not been altered, is comprised of grasses, *forbs*, shrubs, and trees. Rangelands within the floodplain of the Milk are generally level. Outside the Milk River floodplain, the landscape turns to rolling hills crossed by drainages. Soil moisture varies on these rolling landscapes, but concentrates in the drainages, and north facing slopes.

Potholes, another important feature of the watershed, are numerous in a large area in the northern third of the *basin*. The average size is less than two acres, but can be up to ten acres. In years of average precipitation, potholes will dry up by June or July, but in spring they provide water and a temporary habitat for livestock and wildlife. *Prairie potholes* provide particularly important habitat for annual waterfowl migrations north and south.

Badlands are yet another geologic formation within the watershed. These have highly erodible soils, steep and sparsely vegetated slopes, and deeply incised drainages. Even with good rainfall, erodible soils make the badlands unproductive.

Riparian areas are located close to water sufficient to support woody vegetation and water loving plants. Riparian areas are a valuable resource because their water and diverse vegetation provides habitat for many diverse wildlife species. Riparian areas along the Milk River tend to be very small because the river channel is *incised* along most of its reach. From the normal water level to the top of the bank is at least ten feet in many areas. Along the Milk, the riparian area is usually somewhere between the normal water level and the top of the riverbank.

Other riparian areas include *oxbows* and *sloughs* along the river. Beyond the river corridor, springs, stock water dams, irrigation reservoirs, and tributaries also provide riparian areas.

Photo by George Bendo.

A rock formation in the Havre badlands.

Photo courtesy of USDA-NRCS.

Milk River riparian area north of Hinsdale.

Rangeland Uses in the Milk River Watershed

Livestock production is the major use of rangeland in the Milk River Watershed. As of January 1, 2000, there were 242,700 cattle and 9,900 sheep in Valley, Phillips, Blaine, and Hill counties. There were also 2,372 farms in the same counties. Other uses of rangeland are hunting, fishing, and wildlife viewing. Minerals beneath the rangeland make the Milk River Basin one of the largest natural gas producing areas in the nation, and rich in archeological and paleontological resources.

—Agricultural Statistics

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Throughout the history of the Milk River Watershed, the river has brought residents together and thrust them apart. Time and time again, through droughts, floods, and even the 'average' water year, Canadian and American watershed residents are reminded they share a common need for water.

Chapter 2

An Historical Sketch

The labor of diverse populations laid the foundations of today's agricultural watershed economy. From the early buffalo trade of resident Native American tribes; to explorers and trappers; to the coming of the transcontinental railroad and homesteaders, water was always at the center of life. By the end of the 19th century, serious efforts were being made on both sides of the 49th Parallel to develop a reliable water supply for farmers homesteading arid land. The abbreviated history below provides a snapshot of the rich history of the Milk River Watershed, highlighting five topics that laid the foundations for life in the watershed today.

Natives and Early Inhabitants

The first residents of the Milk River Watershed were Indian tribes. The Blackfeet (comprised of three bands—the Blood, Piegan and Blackfeet); the Gros Ventres; Assiniboine; Chippewa; and Cree occupied different areas of the watershed. The Blackfeet ranged from the Missouri River north to Upper Saskatchewan. The Gros Ventre, descendants of the Algonquin, occupied some of the same area further east, ranging from north of the Missouri to the Cypress Hills in Alberta and Saskatchewan. The Assiniboine roamed the region between the Saskatchewan and Assiniboine Rivers in the North, and the Bears Paw and Little Rocky Mountains, south, in Montana. Often called 'the landless Indians' because they were scattered throughout the region, the Chippewa and Cree migrated to the Milk River area from Canada in the 1870's.

Early records of white men in the region indicate that the first Europeans to reach the Rocky Mountains, in 1742, were the sons of French fur trader Pierre Caultier de La Verendrye. Other trappers followed, but Americans Meriwether Lewis and William Clark get credit for naming the Milk River as they journeyed west on the Missouri River in 1805. The famed American explorers paused at the Milk River's confluence with the Missouri on May 8, 1805 and observed:

> *"The water of this river possesses a peculiar whiteness, being about the color of a cup of tea with the admixture of a tablespoon of milk. From the color of its water, we called it the Milk River."*

Prior to the white man's arrival, the natives were nomads and traders. They followed the abundant buffalo herds to supply their fundamental needs. The arrival of white hide hunters and others brought dramatic changes. Some white hunters reportedly killed up to twenty-five buffalo a day. With buffalo hides selling for three dollars apiece, many native peoples also capitalized on the trading opportunity. By the spring of 1880, the buffalo had entirely disappeared from the Milk River country. By 1881, many of the Indian tribes were destitute. By the turn of the century, the tribes were confined to reservations.

Photo courtesy of Montana Historical Society.

Piegan camp on St. Mary Lake, Montana 1916.

Photo courtesy of Montana Historical Society.

Track-laying crew between Havre and Ft. Assiniboine, 1887.

The Arrival of the Railroad

The vagaries of carving out a successful existence in the Milk valley did not produce much permanent white settlement on the American side of the border until James J. Hill brought the Great Northern Railroad through the Hi-Line region in 1887.

The railroad workers reached Fort Assiniboine on September 6, 1887 where they were met by the fort's brass band. Originally, the fort served as the railroad's western headquarters, but when Beaver Creek's water supply proved unreliable, Hill moved the headquarters to Bull Hooks Siding (a name later changed to Havre), which was said to have exceptional well water and lots of it. In addition to Havre, most of the largest communities on the Hi-Line today owe their origin to the Great Northern, for they were established as railroad stops along the line.

Following the Milk River from its mouth near Nashua, the railroad had a tremendous impact on the settlement of the watershed. Although stockmen like Simon Pepin had been in the basin since 1882, the coming of the railroad (and the severe winter of 1886-1887) caused a real influx of cattlemen seeking new grazing lands and easy transport for their livestock to eastern markets. Homesteading farmers followed, attracted by the opening of the first irrigation project in the lower Milk River Watershed in 1895. Early farmers located near the river or its tributaries, where it was easiest to construct irrigation canals. The first irrigation project on the lower Milk River began near Chinook in the fall of 1889, when T.B. Burns joined with neighbors to build a canal from the river to irrigate their land. Two years earlier, a colony of Mormons fleeing prosecution from anti-bigamy laws in Utah, imported their experiences with irrigated agriculture to lands they claimed, upstream, in southern Alberta.

Montana Water Development: The Milk River Project

In addition to the settlement momentum created by the coming of the railroad, the federal government encouraged agricultural settlement through the U.S.'s Homestead (1862) and Desert Land (1877) Acts. The Homestead Act gave the farmer 160 acres 'free,' except for a small filing fee. After a five year period of working the land, the homesteader got full title to it. The Desert Land Act allowed homesteaders to obtain a full section of land (640 acres) for only $1.25 per acre, if the land was worked and irrigated within three years. In Montana, stockmen benefited more from these acts than farmers, who could not avoid the expensive challenge of bringing water to lands far from a water source.

Between 1887 and 1910, most incoming settlers were ranchers and dry land farmers. But with the election of Theodore Roosevelt in 1901, and with creation of the Reclamation Act of 1902, the stage was set for improved agricultural conditions in the Milk River Watershed. The Reclamation Act authorized construction and maintenance of irrigation works for the storage, diversion and development of waters for reclamation of specified lands. It created a Reclamation Fund to help finance construction and land reclamation. And it aimed to recover the costs of the funded projects over time, by assessing fees on those whose lands benefited from the irrigation projects. The intent was that after the project costs were recovered, an irrigation project would be turned over to local water users' associations for ongoing operation and maintenance.

The Milk River Irrigation Project, authorized in 1903, was one of the first irrigation projects initiated in the United States under the 1902 Reclamation Act. The project's objective was to provide a stable source of water for irrigation of the lower Milk River valley. Landowners had learned early that snowmelt in the Rockies would not provide reliable flows in the Milk for irrigation in the downstream end of the watershed. Consequently, a plan to divert water from the St. Mary River to augment the Milk was a key component of the project. The plan would also create water storage for flood control and agricultural *water uses* along the Milk River.

Excavation of the American St. Mary Canal began in 1907. Many Blackfeet Indians hired on to work the canal, all built with horse drawn *fresnos* and *tumble bug scrapers*. However, further development was slowed, pending resolution of international tensions caused by competing development plans.

Photo courtesy of Montana Historical Society.

Southeast 1st Street and 3rd Avenue, Havre, Montana 1890. Sitting are Simon Pepin and A. G. Station

Canadian Water Development and the St. Mary River

In contrast to policy in the United States, irrigation was initially not part of the Canadian government's plan for development of the west. So early irrigation in the Canadian portion of the Milk River Watershed was on a limited scale, primarily as community efforts begun by ranching companies to improve pasturelands and create garden plots.

Contrary to the active role of the U.S. government in Montana's water development, the Canadian government's response to public pressure for water development was to support private companies such as the Canadian North West Irrigation Company (CNWICo). One way they did this was by selling the company 500,000 acres of land northeast of Milk River Ridge (about 1900), at the same time authorizing diversion of water from the Milk River.

The shift to more large scale development of irrigation in western Canada began in 1898 when construction started on an irrigation project on the St. Mary River. One important motive driving its development was concern that Montana was making plans to divert water from the St. Mary River to the Milk. The successful creation of Canada's St. Mary project gave Canada first claim to water from the St. Mary River. This fact was of considerable significance as competition for water between Montanans and Albertans escalated at the turn of the century.

In 1902 Canada asked the U.S. not to proceed with plans to develop an American St. Mary canal because it would be "injurious to Canadian interests." Initial diplomatic discussions of the issue held late that year were unsuccessful.

In spite of additional informal conversations held between Canada and the U.S. between 1903 and 1905, the CNWICo began constructing a Canadian Milk River Canal. They hoped to divert any water Americans might obtain from the St. Mary River (intended to increase Milk River flows in Montana) and, instead, irrigate Albertan land east of Milk River Ridge. Though the Canadians' long term plan, including two dams, never came to fruition, this so-called 'Spite Canal' demonstrated that competition for scarce water had reached international dimensions.

The Malta Plan Meets the Milk River Irrigation Project

The Great Depression and drought of the late 1920s and 1930s prompted America's first resettlement program: "the Malta Plan." Located in Phillips County, Montana, the plan involved retirement of submarginal farm lands and relocation of the impoverished families who worked them. This plan, together with the Milk River Irrigation Project, made for dramatic changes.

"From the inception of the Milk River Project until the 1940s, the economic and settlement patterns had shifted from a predominantly ranching, small-scale irrigation, and dry farming pattern, to a pattern dominated by irrigation farming. Previously, residents planted a few crops of oats, wheat, and clover for forage. Farmers on the transformed project, however, expanded the crops to include planted grains, sugar beets, potatoes and an array of other vegetables. In 1913, only forty-one farms with a population of 126 people were irrigated by the Milk River Project. The project had three towns with five churches and two banks. The total population of the area was 1,679 people. By 1940, the project served almost 700 farms, having a population of 2,684 people. The number of towns had mushroomed to seventeen, the number of churches to thirty-six, and the number of banks to seven. Thirty-three schools served the populace.....the Milk River Project, like other irrigation projects in Montana and the west, transformed the cultural landscape of the area."

—Excerpted from "The Historic and Cultural Resources of the Milk River Project", Rolla L. Queen, U.S. Bureau of Reclamation, 1991.

Photo courtesy of Montana Historical Society.

Old threshing rig on the Wilson Ranch, Kremlin. 1915.

The Boundary Waters Treaty of 1909

American and Canadian actions and reactions finally brought the U.S. and Canada together to negotiate. The Boundary Waters Treaty of 1909 was the result. Article VI of the treaty apportioned the waters of the Milk and St. Mary Rivers as one stream for purposes of irrigation. The agreement was revised in 1921, and today, the waters of the two rivers are divided "equally" during the *irrigation season.* During the irrigation season, the United States receives 3/4 of the flow of the Milk River (below 666 cubic feet per second) and Canada receives 1/4 of the flow. On the St. Mary River, Canada receives 3/4 of the flow and the United States receives 1/4 (below 666 cubic feet per second) during the irrigation season. Flows in excess of 666 cubic feet per second are to be divided equally for both streams. During the non-irrigation season, the flows are to be divided equally for both streams.

The Treaty also addresses the division of flows for tributaries of the Milk that originate in Canada, such as Lodge Creek, Battle Creek, and the Frenchman River. During the irrigation season, flows from these streams are divided equally (50% to each country). A set of rules and a series of gauging stations operated by the United States Geological Survey and Water Survey of Canada help to ensure that each country gets their proper share of water.

An Agricultural Economy

Settlement of competing claims for the Milk and St. Mary Rivers opened the door to eventual completion of the Milk River Irrigation Project in Montana, first begun in 1907 (see map pp. 22-23). The major components of the Milk River Irrigation Project were constructed between 1907 and 1939. Most parts of the project were in place by 1924, though Fresno Dam and Reservoir were not completed until 1939. All told, the St. Mary Diversion Canal and Milk River Project involved construction of seven major storage and diversion dams and approximately 419 miles of canals and laterals, making reclamation of approximately 125,000 acres of agricultural land possible in the lower Milk River Valley. For a region plagued by chronic water shortages, the Milk River Irrigation project made successful agricultural production possible, on a scale that was, otherwise, impossible .

In sum, the 20th century history of the Milk River Watershed was marked by the changing face of agriculture. Irrigation secured the 'backbone' of the region's agricultural economy. The history of the Milk River Watershed does not end here. But space limits dictate a mere historical overview. The legacies of the events described above linger. American Indian residents remain proud inhabitants of the Milk River Watershed. Hardy remnants of homesteading populations still inhabit the towns and farms built along the old Great Northern Railway tracks. The agricultural lifestyle and economy created through Canadian and American water development, shaped by the Boundary Waters Treaty of 1909, persists. Then, as now, residents of the Milk River Watershed have adapted, endured and coped with nature's less than predictable water supplies.

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This chapter contributed by: Mary Ellen Wolfe.

Where the Milk River's Water Comes From, Where It Goes

Chapter 3

Water Supply & Distribution

Inter-basin water transfers, treaties, and *compacts* present many unique challenges for Milk River Basin water managers. Eight *irrigation districts*, four Indian reservations, two countries, and numerous other entities must find a way to share and manage a water supply that is frequently less than optimal for many water users.

Sources of Surface and Groundwater

Mountain snowmelt, tributary inflows, and precipitation are the main sources of surface water flows in the Milk River. Between 50 to 80 percent of the water that flows into the Milk River comes from snow melt in Glacier National Park. The remaining 20-50 percent of the water in the river comes from surface runoff throughout the basin.

Mountainous regions also take in water that infiltrates to groundwater aquifers. In the western part of the watershed, for example, terrace gravels have potential for groundwater supplies of good quality and quantity.

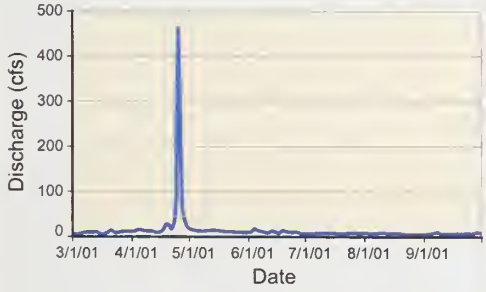
Groundwater supplies in the Milk River Basin vary sharply in availability, yields and quality based on location, geology and climate. Recharge for shallow aquifers tends to come from precipitation and irrigation waters infiltrating downward through soil.

In the western part of the basin, the Virgelle Sandstone is a prolific and important aquifer. In the northeastern portion of the basin, large gravel deposits provide fair to good quality water for irrigation and domestic use. The Bear Paw Shale dominates much of the plains with very limited potential as a water supply. Sandstone portions of the Judith River Formation supply limited quantities of water that is often highly mineralized. Other aquifers in the watershed, such as the Kootenai and Madison Formations, have not been evaluated for their potential due to depth.

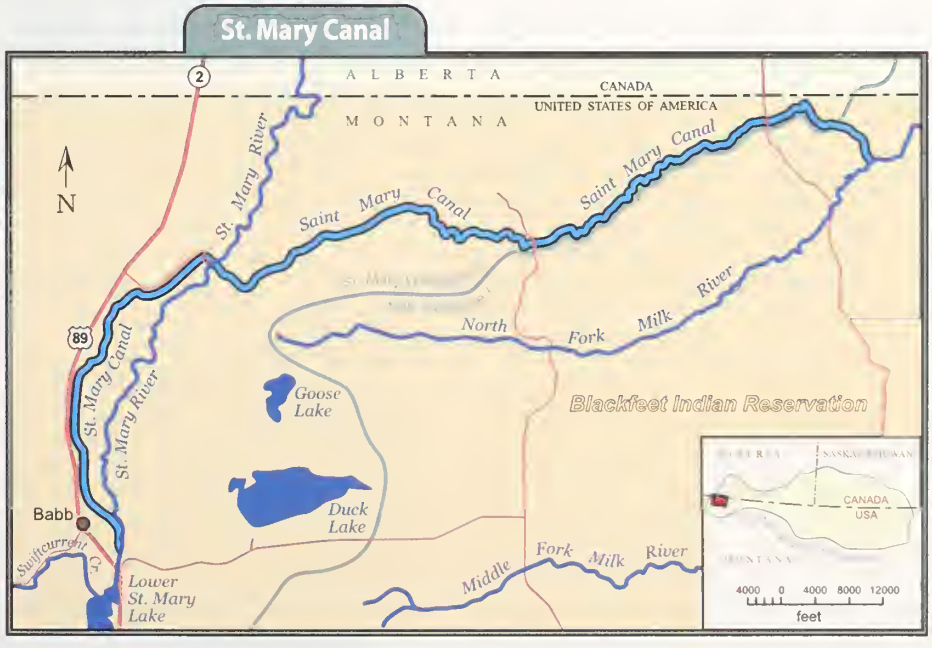
The valleys surrounding the larger tributaries of the Milk River have gravelly alluvium that produces water suitable for domestic and livestock use, but the quantity can be unreliable, and quality undesirable. Valley gravel and coarse sand varying in depth from 45-200 feet can yield adequate quantities of groundwater, but most have high sodium concentrations. The Flaxville Gravel yields good quality water for domestic, livestock and limited irrigation use.

Inter-Basin Water Transfer

As described on the next page, the water diverted from the St. Mary River to the Milk River is essential to Montanans. Without it, basin runoff alone would not keep the Milk River flowing 6 out of 10 years. If the Milk River stopped flowing, the towns of Havre, Chinook and Harlem, and some 820 irrigated family farms, would be without water.



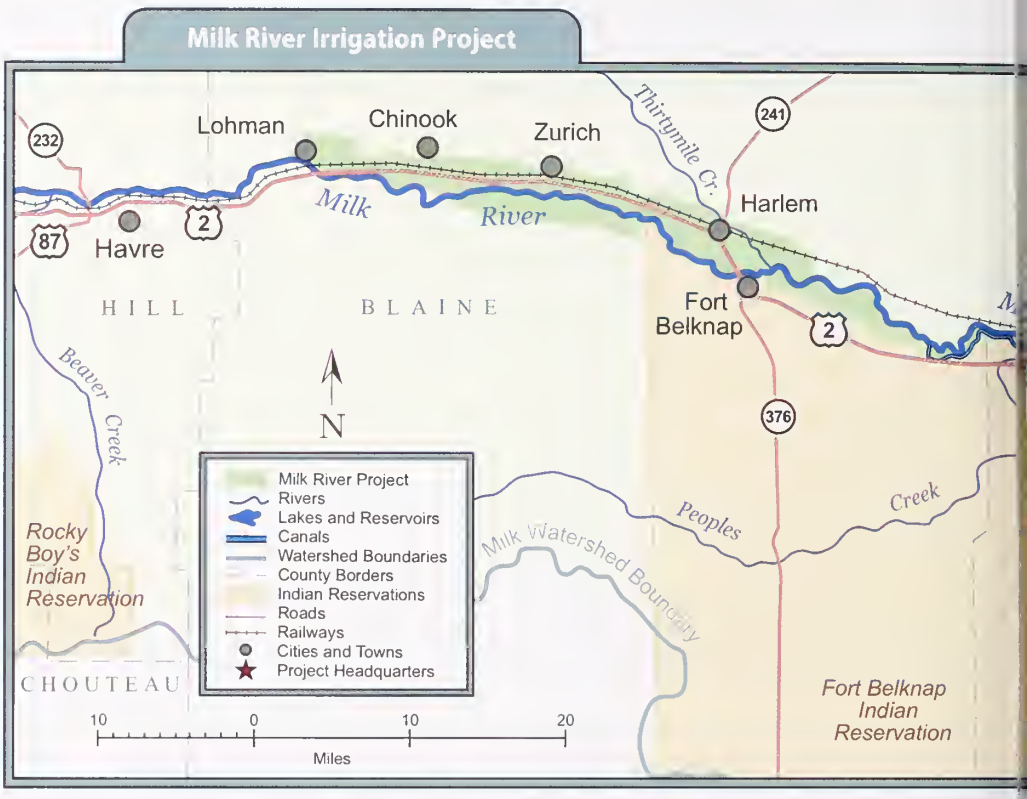
Natural river flow in the Milk River basin is indicated by this hydrograph of USGS gauge data from station 061133500 on the North Fork Milk River above the point where the St. Mary Canal brings in water from the St. Mary River basin.



Surface Water Supply

Water managers say that the Milk River has two 'classes' of water: one is 'natural flow,' and the second is 'project water.' Natural flow is water from runoff that originates in the basin and is not stored in a Milk River Project facility. Project water is stored Milk River water plus water imported from the St Mary River Basin(see map p. 22).

All of St. Mary River water would flow north into Hudson Bay without a very important, but aging, set of water diversion structures near Babb known as the St. Mary Reserved Works. The Reserved Works consist of a diversion dam and the 29 mile St. Mary Canal. The St. Mary Canal in Montana diverts water from the St. Mary River, and carries it to the Milk River North Fork. (There is also a St. Mary Canal in southern Alberta.) Without this imported St. Mary water, natural flows alone would not keep the Milk River flowing 6 out of 10 years. If the Milk River stopped flowing, some 820 irrigated family farms and the towns of Havre, Chinook and Harlem, would be without water. (Combined, these towns use 4.8 million gallons per day or 7.4 cfs during the summer while most farm turnout deliveries range from 2 to 6 cfs). Because of this, supplemental water stored in Fresno and Nelson Reservoirs is essential to maintaining a reliable Milk River water supply.



The most reliable water supply results from the Milk River Irrigation Project storage facilities. Sherburne, Fresno, and Nelson Reservoirs store and regulate water to sustain irrigated agriculture along the Milk River during the summer, and maintain winter flows for municipalities. During dry years, imported St. Mary water can account for as much as 95 percent of Milk River flows. Fisheries, wildlife, recreation, and several municipalities also benefit from Milk River Project water.

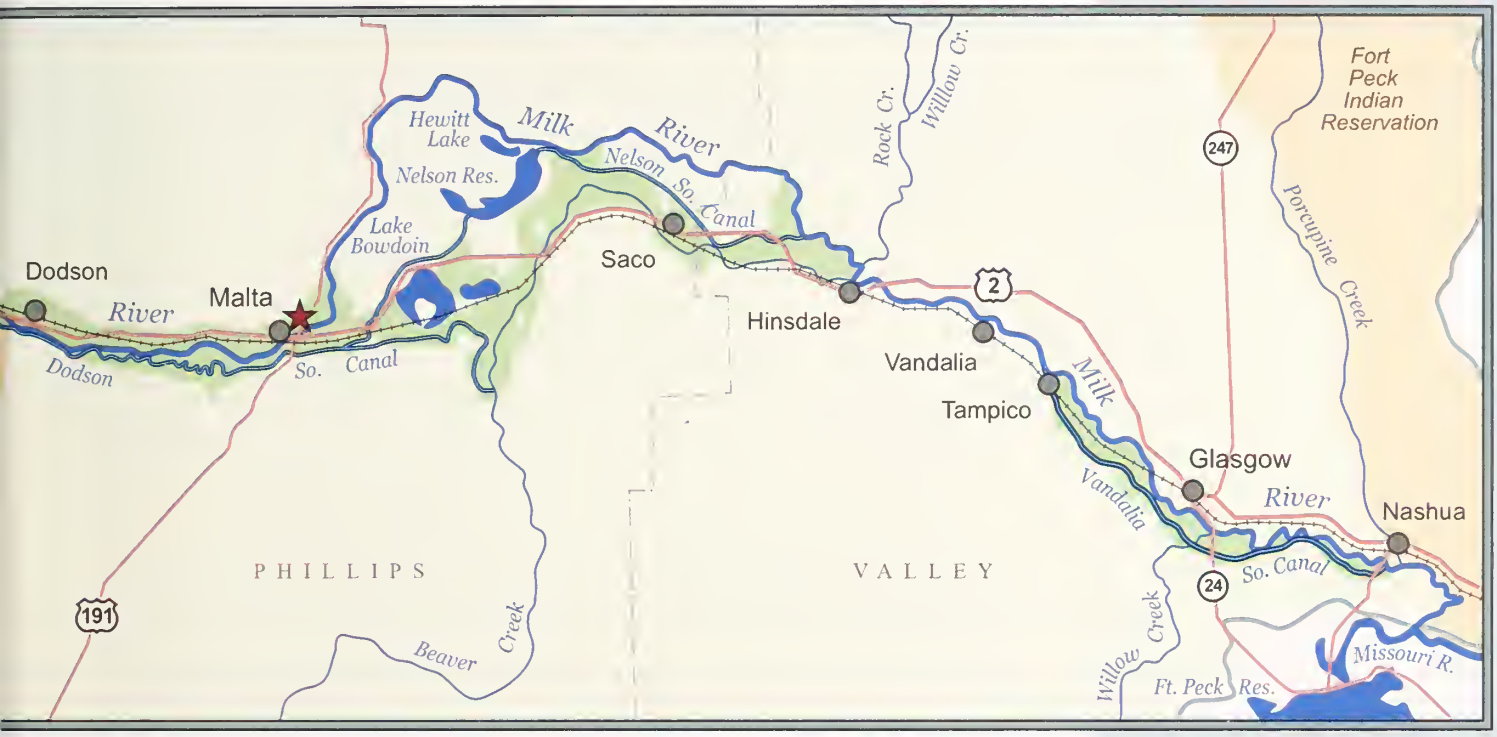
The right to use project water is limited to those who have a contract to use it. Those with contract water include the Milk River Project Irrigation Districts, reclamation pump contractors, the municipalities of Havre, Chinook, and Harlem, the Fort Belknap Indian Irrigation Project, and the Bowdoin National Wildlife Refuge.

The Milk River Project Irrigation Districts consist of the Alfalfa Valley, Dodson, Ft. Belknap, Glasgow, Harlem, Malta, Paradise Valley, and Zurich

Syphons are part of the St. Mary gravity diversion system.

Irrigated agriculture along the Milk River depends upon the reliable water supply provided by the Milk River Irrigation Project.

Photos courtesy of USDI Bureau of Reclamation.



Irrigation Districts. Together, they irrigate approximately 110,000 acres of land. In 1999, the Milk River Project Irrigation Districts organized into a Joint Board of Control for their mutual benefit. One of the duties of the Joint Board of Control is to establish the seasonal water allotment based on forecasted water supply conditions.

In addition to the Milk River Project Irrigation Districts, approximately 11,000 acres are contracted to receive Project Water. The majority of the water is pumped directly from the river. However, some of the contracted acres are served by pumping from district canals.

The municipalities of Havre, Chinook and Harlem all have water service contracts for project water. Havre's contract includes a potable water supply and a 25 cfs release from Fresno Reservoir for dilution of their wasteway return flow.

The Fort Belknap Indian Irrigation Project, managed by the US Bureau of Indian Affairs, has a contract to store natural flow water in Fresno Reservoir. There are approximately 10,000 acres irrigated on the reservation.

There are also 25,000 acres of junior water right irrigated acres in the basin. These acres are entitled to Milk River natural flow water when it is available, but have no claim to use project water.

Water in the Milk River Basin is used over and over again as it moves from Fresno Reservoir to the confluence with the Missouri River. Downstream water users are dependant on return flow from upstream water users in addition to releases from the reservoirs. The expectation from those who contribute financially to the construction and annual operation and maintenance of the project facilities is that those non-project water users only use the natural flows of the Milk River when such flows are available.

Groundwater Supply

Several communities in the Milk River Watershed depend on groundwater for their *potable* water supply. Industrial, irrigation, and mineral recovery activities also rely on groundwater in Alberta, Saskatchewan, and Montana.

Many geothermal springs exist in the area around the Little Rocky Mountains. These springs start in the Madison Formation and have an average water temperature of 75˚F. The Sleeping Buffalo Hot Springs, near Saco, produce 90 gallons per minute of 108˚F water from a well that is 3,200 feet deep.

References

Soils of Montana. 1982. Bozeman, Montana: Montana Agriculture Experiment Station, Montana State University and USDA Soil Conservation Service.

Water Resource Surveys: Glacier County, Sept. 1969; Blaine County, June, 1967; Phillips County, June, 1968; Valley County, June, 1968. Helena, Montana: Water Resources Board.

This chapter contributed by:
Mike Dailey, DNRC, Glasgow Regional Office;
Marv Cross, DNRC, Havre Regional Office.

Demands for water in the Milk River Watershed often exceed the available water supply. In spite of this, many residents have made their livings from the land for years.

Chapter 4

Water Rights

Large investments of time, hard work and money are often required to carry water from distant sources to irrigate land. What protects these investments when water is in short supply? How are competing needs for water resolved? Differing legal systems involving water rights have evolved on both sides of the 49th Parallel, in Montana, Alberta and Saskatchewan, to address these questions and others.

More than 100 teams hit the water during the Fresno Challenge fishing tournament. Fish, wildlife, and recreation are designated "Beneficial Use" of water in Montana.

Montana's State-Based Water Rights

Water rights in Montana are based on the Prior Appropriation Doctrine, simply described as "first in time, first in right." In low water years, when more than one person (*appropriator*) wants to use the same limited supply of water, this doctrine is used to settle disputes. The priority right to divert water from a river or stream for a beneficial use is given to the appropriator who first put the water to use. Once the *priority date* for a particular *beneficial use* is established, the *water right* and its priority date remain attached to the land even if the land changes ownership.

Prior to 1973, a water right could be established in one of three different ways: (1) by putting the water to beneficial use; (2) by filing a notice with the county clerk and recorder's office of the intent to put water to beneficial use followed by actually using the water; or (3) by petitioning the District Court to create *decreed water rights* between disputing parties. There was no single location where records of water rights were maintained. And most of the rights created by simply using the water were never recorded anywhere!

In an attempt to address these and other concerns, in 1973, the Montana Legislature passed the Water Use Act. This act established a system for keeping track of water rights and a process to settle disputes about existing claims to water. It also changed the way water rights could be established. Since July 1, 1973, new uses of water and changes to existing uses require a *permit*. The process of obtaining this permit is handled by the Department of Natural Resources and Conservation (DNRC).

In 1979, the Water Use Act was amended to create the State Water Court to "adjudicate" (finalize) claims for water use in Montana. To deal with the many water rights claims that were made, the state was divided along watershed boundaries into 85 basins. The Milk River Basin has eleven administrative basins within which 26,252 water right claims were made. Before being adjudicated, each claim must be fairly and carefully evaluated. That's a lot of work! Even though the Milk River Basin has been designated a "priority basin" by the Montana Legislature, examining and adjudicating 26,252 claims has proven to be an arduous task. Even as this document is being published, the Water Court, with the technical assistance of the DNRC, continues this challenging task.

In Montana, BENEFICIAL USE is "a use of water for the benefit of the appropriator, other persons, or the public, including but not limited to agricultural (including stock water), domestic, fish and wildlife, industrial, irrigation, mining, municipal, power and recreational uses."

—Montana Codes Annotated 85-2-102

Federal Reserved Water Rights in Montana

Water rights for Indian Reservations and other federal lands (like Bowdoin National Wildlife Refuge and Glacier National Park) differ from state-based water rights, because they are based on federal court decisions, treaties and law. Interestingly, it was in the Milk River Basin that a dispute between Fort Belknap Indian Reservation irrigators and neighboring homesteaders led to the 1908 U.S. Supreme Court decision that first described these unique rights. Known as the Winters Decision, the Court decided that when the Ft. Belknap Reservation was created, sufficient water was implicitly 'reserved' for the future, to fulfill the purposes for which the land was set aside. Although the homesteaders had water rights under Montana law, the Court deemed the water right of the Ft. Belknap Indians was prior because the reservation was created in 1888.

Because the Winters Doctrine left Indian water rights unquantified and reserved for future use, Montana created the Reserved Water Rights Compact Commission in 1979 to clarify the nature and extent of those rights through a negotiation process. This process usually brings members of the tribe together with the Compact Commission and other state and federal officials, who work together over time to *quantify* the tribes' water rights. Although the negotiation process can be time consuming, the

Reserved Water Rights Compact Commission

The Reserved Water Rights Compact Commission is made up of nine members who serve for four-year terms. One member is appointed by the State Attorney General's Office, four by the Governor's Office, two by the Speaker of Montana's House of Representatives, and two by the President of the Senate. The work of the Commission is supported by a twelve member staff.

alternative is to quantify the rights through litigation (lawsuits), which can be very expensive and produce less satisfactory results for all involved.

As of this writing, settlements have been negotiated for three of the four reservations in the Milk River Watershed—Rocky Boy's, Fort Belknap and Fort Peck. The Rocky Boy's Compact has been approved and ratified by all parties. The Fort Belknap Compact has been approved by the Montana Legislature. It awaits ratification by the U.S. Congress, the tribe as a whole, and the Montana Water Court, which will incorporate it into the statewide *adjudication* process. The negotiation process has begun, but is moving much slower with the Blackfeet tribe.

The Fort Peck Compact is complete, but not yet ratified by Congress. However, this Compact has little influence on the Milk River Basin. The Fort Peck Tribe has few reserved rights within the Milk River basin. So when their water uses in the Missouri River Basin were compacted in 1985, their rights in the Milk River basin were largely excluded. In fact, no water rights on the mainstem of the Milk River were included in this Compact.

There are four Indian Reservations either totally or partly contained within the Milk River Basin:

- Blackfeet
- Fort Belknap
- Fort Peck
- Rocky Boy's

Canadian Water Rights

Water Legislation in Alberta

Water legislation in Alberta began in 1894 when the Federal Government instituted the Northwest Irrigation Act. Like Montana, provincial water is administered on the principle of "first in time, first in right," where the priority of a license is based on the date of application. Licensees with senior priority are entitled to receive their full allocation of water before those with a more junior priority, regardless the purpose of use.

In 1931 the Province assumed control of water management from the Federal Government and passed the Water Resources Act. The Act was updated in 1999 with proclamation of the Water Act, which now provides Albertans the tools for administering provincial water.

Under the Water Act there are three methods to establish a water right, whether the water comes from a surface or groundwater source:

1. **Household Statutory Right**
   The Water Act provides for a statutory right for household use up to 1250 cubic meters (1 acre-ft) annually for human consumption, sanitation, fire prevention and watering animals, gardens, lawns and trees. The water source must naturally occur on or under the land where it is used and the household right has priority over all other users.
2. **Registration for Traditional Agricultural Use**
   The Water Act gave agricultural water users who used water before January 1, 1999 under the old unquantified term 'Domestic,' the opportunity to register their use and receive a priority number dating to the time of first use. The registration was for a maximum of 6250 cubic meters (5 acre-ft) per farm unit. The water source was required to be on or under the land where it is used and the priority assigned to the registration has equal standing to all licenses in the system. This opportunity expired December 31, 2001.
3. **Licensed Use**
   The Water Act continues the issuance of licenses begun in 1984, for all types of use, and continues administration based on priority. Each license states a specific annual volume, rate of diversion and specific point of diversion, as well as conditions that regulate when and how the water may be withdrawn.

Alberta's Water Act provides several other tools for administration, particularly useful in water short areas of the province. Water assignments (sharing) are possible where two licensees who wish to reduce the use of a senior license may increase the water available to a junior license. The agricultural community has used water sharing to protect high valued crops, like sugar beets. This is done when two water licensees (junior and senior) agree to reassign water intended for the senior licensees' lower valued crops to the junior licensee's higher valued crop. Water assignments have become a useful tool for industrial and municipal licensees in Alberta, as evidenced by the more than 600,000 acre feet shared among 660 licensees in 2001.

The Water Act provides an opportunity for the transfer of a water right, which was previously tied to the land. A holder of a license "in good standing" can apply to transfer a water right to another use, another location or person, for all or a portion of a license, permanently or for a designated time period. Transfers are subject to the provisions of a Water Management Plan. (Water Management Plans are a tool provided in the Water Act for the public to have input into water management issues specific to their area.) Transfers are approved only if the rights of an existing user are not impaired and there is no adverse effect on the aquatic environment.

A third tool is water conservation objectives (WCO), which work towards establishing a "water right" for instream flows. A license with a priority can be issued to the government to maintain a rate of flow or a water level in a waterbody. Once established, the WCO allows for flexibility because it can be increased through cancellation of existing licenses or a 10% holdback on transfers, when they occur. The establishment of a WCO also provides for stability because all licensees know where the Water Conservation license fits within the priority system.

Measuring Water

How much water is there? How much is being used? Various automated monitoring stations, some of them in remote locations, provide reliable answers that can help resolve competing needs for water in the Milk River Watershed.

USGS monitoring gage station at Cree Crossing on the Milk River.

USBR HydroMet station on the Nelson Feeder Canal.

Photos courtesy of USDI Bureau of Reclamation

Water legislation in Alberta is adapted to meet the flexible needs of a changing economy and to protect the aquatic environment. The Water Act gives the public tools to prepare for variable water supply at their own comfort level with risk and allows for the exchange of allocations (licenses) at the value placed on them by the public.

Water Rights In Saskatchewan

In 1894, Saskatchewan started out as most western states and provinces with federal water right legislation which operated under the principle of "first in time, first in right." That legislation dealt primarily with water use related to irrigation, since that was the most significant use in the west at that time, but other uses such as domestic and municipal, were included too.

After 1931 water rights became a provincial matter and The Water Rights Act was instituted in 1940. It was also a priority based system and included a priority by type of use such as municipal, industrial, irrigation, and so on. *Riparian rights* were also protected. A water right holder who sold the land to which the water right was assigned could transfer the right to the new owner, or within reason, transfer the right to another location in the watershed. The individual could not retain the right without making beneficial use of the water nor could he retain the right for sale independent of the property. The Water Rights Act offered little management ability, particularly in water short years, to ensure the most beneficial use of water.

Riparian rights have evolved and changed over time. Prior to 1931, a landowner had the right to the uninterrupted flow of the water in its natural state, subject to reasonable use of the water by owners above for domestic purposes and for cattle. Through legislative change such rights now provide the owner occupying land adjoining a body of water such quantity as he may require for domestic purposes, without acquiring a license, providing the water is available at that location.

In 1984 new legislation was created, called The Water Corporation Act, The new legislation addressed surface water and groundwater uses as well as drainage legislation. The Water Corporation Act removed the priority of "first in time, first in right" and priority by type of use. Allocations of water became protected solely by availability. Municipalities and most industrial users are allocated water on a basis of 100% firm availability, meaning watershed allocations are discontinued if any municipal or industrial user is likely to experience any shortages. Irrigation availabilities range from 50 to 85%, depending on the type of irrigation system. Riparian rights are now limited to the use of water from an adjacent water body only if there is water in the stream; there is no longer an ability to demand that flow be maintained. Approvals became *appurtenant* to the land irrespective of change in land ownership but are subject to beneficial use of water, so the landowner cannot sell the water allocation independent of the land.

Information, Permits & Licenses

In Montana

DNRC Regional Offices -
Havre (406)265-5516
Glasgow: (406)228-2561

Montana Water Court -
1-800-624-3270 (toll free, in state)
or 406-586-4364

Montana Reserved Water Rights Compact Commission -
(406)444-6841 or
http://www.dnrc.state.mt.us/rwrcc/index.htm

In Alberta

District Approvals Manager
Southern Region
Alberta Environment
200 Fifth Avenue South
Lethbridge, AB T1J 4L1
(403)382-4254

In Saskatchewan

Saskatchewan Watershed Authority
(previously SaskWater)
Swift Current Regional Resource Office
350 Cheadle Street West
Swift Current, SK S9H4G3
(306)778-8257

This chapter contributed by:
Marv Cross, MT DNRC, Havre Regional Office;
Dave McGee, Alberta Environment;
Rob Wiebe, Saskatchewan Watershed Authority.

What is the quality of water in the Milk River Watershed?
Is a suitable quality of water available for every use?
To answer these questions we need to know more.

Water Quality

The Milk River and its tributaries sustain many uses—crop production, livestock water, recreation, wildlife, rural and urban domestic water, and more. Ground and surface water sources are used to meet these diverse needs, each requiring a sufficient quantity and a suitable quality of water to be fully satisfied. (Though in a region where water is often scarce, water of any quality is valuable.)

What Is Water Quality?

The meaning of the term water 'quality' varies according to how water is used. In fact, the quality of water actually dictates its use.

All waters in the state have been classified and defined by the Montana Department of Environmental Quality (DEQ) based on actual and anticipated uses. Under this state classification system, the Milk River is classified as a B-3 water (see text box this page). To insure that water quality is safe, water quality standards were created which serve as goals to help us determine whether water quality in a given water body is suitable for established (or expected) uses.

Types of Water Quality Impairments

A wide variety of potential *constituents* (pollutants) may impair the quality of any surface or groundwater resource. Some of these constituents occur naturally while others are the result of human activities. Elevated levels of salts, metals, nutrients (i.e. nitrogen, ammonia, and phosphorus) and *turbidity* are some of the specific pollutants that create water quality concerns in the Milk River basin. When additional levels of constituents are added to the natural level already carried by the water, an overload to the system can occur. A body of water can only tolerate a certain level of pollutants before the beneficial uses of the water are impaired or severely limited.

Some impairments come from one specific source or pipe, and are called *point sources* (like wastewater treatment plants). Those that come from multiple sources are known as *non-point sources* (like agricultural land or forested areas). Non-point sources of contamination are harder to control because it can be difficult or impossible to determine their exact source. Evaluation of land use practices within the watershed can help us understand the range of different sources that may be contributing to water quality concerns in the basin. Armed with this knowledge, basin residents can implement strategies, or change land use practices to reduce or correct the source of water quality impairment.

Salts such as carbonates, calcium, magnesium, potassium, sodium, sulfates and chlorides are common in the Milk River Watershed. However, when salts are present at elevated concentrations they can change the physical and chemical nature of the water. High concentrations of salts in water can inhibit and, sometimes, prevent the growth of plants used for agriculture crops, lawns, and gardens.

Salt concentrations are commonly measured as Total Dissolved Solids (or TDS). Water with a measurement of TDS above 500 milligrams/Liter (mg/L) is undesirable for human consumption, but may be acceptable for other uses. A value over 7,000 mg/L is not suitable for livestock watering.

The hardness content of water is an example of a common, non-threatening, natural salt constituent. "Hardness" is the measurement of calcium and magnesium salts in the water. A measurement range of 0-75 mg/L is considered "soft" water, 75-150 mg/L is "moderately hard", 150-300 mg/L is "hard" water, and >300 mg/L is "very hard" water. Groundwater in the Milk River basin is usually in the "hard" to "very hard" range, and surface waters are generally "moderately hard." The large amounts of calcium and magnesium salts in very hard water can cause scaling in pipes and fixtures, which may lead to maintenance problems.

Metals are found in certain tributaries of the Milk River. Sources may be natural or may be related to past or current mining activities. The geology surrounding a groundwater aquifer can also contribute metals. For example, iron and manganese are common metals found in many groundwater sources. These impurities usually create color and staining problems in household fixtures. Because the removal of metals involves specific treatment, such impairment will remain until physically removed or chemically changed.

Nutrients such as nitrogen, ammonia and phosphorus occur naturally in all waters. They are by-products of the biological decomposition of organic material, so they occur in a continual cycle in nature. These nutrients may also be residues from commercial products such as fertilizers, detergents, and cleaning products. Nutrients can cause problems in waterways by creating algal blooms. They can also lower the oxygen content in the water, which alters conditions necessary for fish and other inhabitants of the waterway.

The Milk River—B-3 Waters?

B-3 is the classification given to the waters of the Milk River by the State of Montana. This means these waters are suitable for drinking, cooking and food processing after *conventional treatment*; bathing, swimming and recreation; growth and propagation of warm water *non-salmonid* fishes and associated aquatic life, waterfowl, and furbearers; and agricultural (irrigation and livestock watering) and industrial water supply.

Photo courtesy of USDA-NRCS.

What Causes Water Quality Concerns?

A variety of causes, including natural sources and human (or 'introduced') activities, give rise to water quality concerns in the Milk River Watershed.

Natural Sources

The topography of the Milk River basin contains natural sources of impairments like alkaline, acidic or eroded soils. These contribute to the soil conditions that can affect water quality in the basin. For example, spring runoff from the many tributaries that feed into the Milk River can contribute natural impurities. Where tributary waters move along eroded banks, they pick up silt and sediment and carry it to the Milk River. Because these tributary flows can, at times, make up most of the flow in the river, they create water quality concerns in the river itself.

Salts present in the glaciated soils of north central Montana can impact water quality through the formation of *saline seeps*. Saline seeps form as a result of groundwater dissolving and transporting salts present in subsoil and bedrock deposits. Under certain conditions, the groundwater will discharge near the soil surface, where the water evaporates, leaving the salts behind. Saline seep water is mostly sodium and magnesium sulfates and can be as salty as seawater! Over time, the salts accumulate on the soil surface to form a saline seep. A white crust forms where the salt concentration is very high. During a rainstorm, surface runoff can flush the accumulated salts into a nearby *watercourse*, which may have a negative effect on water quality. In addition, wind can spread the dried salt deposits over the landscape, some of which may come to rest in local water bodies.

Saline seeps also make the soils inhospitable for many agricultural crops. The result is reduced crop yields and loss of productive land. Although some saline seeps form naturally, many others are the result of land use practices such as irrigated agriculture.

Riparian areas in the Milk River Watershed further illustrate how soils and the vegetation they support can affect water quality. Healthy riparian areas have healthy vegetation (willows, grasses, trees) growing along the banks of the river. The plants' root systems help to stabilize soil and reduce bank erosion that can be a source of sediment. Healthy riparian vegetation also helps to filter out and trap other contaminates. Consequently, areas in the Milk River basin with established riparian areas tend to have better water quality than those without. Canopy cover provided by shrubs and trees also improves water quality conditions, providing cool shade and temperature variances in the water.

Human Activities

Human activities can affect water quality in a variety of ways. Agriculture, mining, forestry, industry, urban, conservation, and natural gas developments are land use practices in the Milk River basin that, if not done properly, can all degrade water quality.

Even developments like dams that are built to contain or conserve water can have unforeseen negative effects on water quality. How so? Dam releases create fluctuating water flow rates and changing water volumes that can alter the river channel and cause bank erosion. Silt from bank erosion is a problem throughout the basin. Silt increases turbidity and higher turbidity levels increase treatment costs for drinking water suppliers. Maintenance costs for pumps and equipment used along the river may also increase.

A number of other examples illustrate how human activities can lead to water quality concerns.

- Mining operations remove fertile topsoil and disrupt historical land use practices; mining wastes can contain heavy metals and substances toxic to plant and animal life;
- Forest harvest and the roads necessary for it can change vegetation and cause runoff to nearby watercourses;
- Urban development can remove wetlands and riparian vegetation, alter streambanks and create runoff problems;
- Natural gas developments may alter soils and the resulting wastes are high in sodium;
- Agricultural practices, including livestock production and irrigation, can disturb soils susceptible to bank erosion, alter riparian areas and carry silts and sediments to nearby watercourses.

This is not to say that humans should cease these economic activities; they are part of our lives. Instead, we can be aware that our activities may affect water quality, increase our knowledge of the broad variety of resources and tools available, and practice land uses that have little or no negative impact.

Saline seeps, like this one in Liberty County, can result in reduced crop yields and loss of productive land, and contribute to the salinity of local bodies of water.

Silt from bank erosion is a problem throughout the watershed.

Photos this page courtesy of USDA-NRCS.

Water Quality Concerns Are Nothing New to Milk River Watershed Residents

Water quality concerns in Montana have a history at least as old as water quantity concerns. Population increases between 1907 and 1939 were accompanied by health concerns. But limited scientific understanding made water quality protection measures slow to emerge. Eventually, the State Board of Health 'discovered' that many watershed residents were sick because of the conditions of Milk River drinking water sources. During this time, there were no formal wastewater treatment processes for sewage or other wastes. Wastes were directly discharged into the Milk River with the remedy thought to be: "The solution to pollution is dilution." A contract between the U.S. Government and the City of Havre (dated Dec. 7, 1936) and contracts with the City of Chinook, Town of Harlem, Great Northern Railway and Utah-Idaho Sugar Company, assured adequate river flow (approximately 25 cfs) from a completed Fresno Reservoir. Each contracting entity contributed toward construction of the Reservoir. Today, existing contractors continue to pay annual operation and maintenance costs.

The City of Havre's sole drinking water source was well water until 1950. Water treatment and wastewater treatment facilities were built in 1950. Facilities for downstream towns were built after this time also.

Photo courtesy of Montana Historical Society.

Hauling ice in the 1920s, Havre, MT.

Photo by Ernest White; courtesy of Montana Historical Society.

Wagon loads of sewer pipe at Glasgow, MT, ca. 1907-1909.

Why Should We Care?

Improved understanding of the sources and causes of water quality impairment in the Milk River Watershed prepares residents to use water with care. Awareness of the ways that human activities can harm water quality is vital for Hi-Line residents committed to doing their part to protect water quality in the Milk River Watershed for present and future generations.

Information

City of Havre
- Water Plant (406)265-5215
- Wastewater Treatment Plant (406)265-9031

City of Chinook
- Water Plant (406)357-2120
- Wastewater Treatment Plant (406)357-2188

City of Harlem (406)353-2361

Town of Dodson (406)383-4443

City of Malta (406)654-1251

Town of Saco (406)527-3312

City of Glasgow (406)228-2576.

Town of Nashua (406)746-3461

Montana Department of Environmental Quality Water Protection Bureau (406)444-3080

Environmental Protection Agency (406)441-1130

This chapter contributed by: Kristi Kline, Havre Wastewater Treatment Plant.

Spring floods caused by snow melt in the Milk River Watershed typically require snow pack accumulations to be 150-200% above normal. The 1951-52 seasonal snowfall of 60.9 inches, which was 185% of normal, established the record for Glasgow, Montana.

Chapter 6

Floods & Floodplains

History of Flooding on the Milk River

Floods are a natural part of the *hydrologic cycle* in every river basin. Historically, major flooding in the Milk River basin occurs in the spring as a result of rapid snowmelt on frozen soil, often accelerated by chinook winds. Heavy summer thundershowers are another cause of flooding in the watershed. Seasonal warming trends progressing from the mountains to the plains may also have an affect, by boosting flood peaks downstream at the river's end near Glasgow and Nashua.

There have been twenty-two floods the past 100 years in the lower Milk River, south of the U.S.-Canadian border. Eighteen of these flood events were the result of rapid snowmelt and four were due to warm season thundershowers. Rapid springtime snowmelt has been responsible for the largest floods in the Milk River drainage. In 1952, spring flows at Nashua were recorded at 45,300 cubic feet per second (cfs). This flood was equivalent to a 100-year flood event for Nashua.

The relatively impermeable clay loams and clay soils in much of the watershed can intensify runoff. However, the glaciated topography of the Milk River basin does have many sloughs and depressions that retain and store runoff. And the river's wide, flat, floodplains and many tributaries provide tremendous channel storage capacity. These attributes help to reduce flood peaks considerably and extend flood durations over several weeks in much of the Milk River Watershed.

Seasonal Floods and Ice Jams

The typical spring thaw in the Milk River basin takes place over a period of four to six weeks. Normally, the Milk River and its tributaries can transport the snowmelt safely through the basin. Trouble comes when the weather warms suddenly and the snow melts faster than the water can be carried away.

These early spring floods are often accompanied by dramatic ice jam flooding. Ice jam floods arise when frigid air masses linger over the lower elevations of the Milk River, while southern tributaries in the higher elevations of the Bears Paw and Little Rocky Mountains thaw. The warmer tributary streams then flow into the lower and still frozen *mainstem* Milk River, producing ice jam flooding. Ice jam floods frequently produce locally higher flood levels than free flowing floods. The early season March floods have historically resulted in more ice jam flooding than the April floods. Spring ice jam flooding on the Milk River is among the most frequent in the continental United States.

Heavy spring rains can also contribute to flooding in the Milk River basin. The river and tributaries, already filled with snowmelt, cannot accommodate the increased runoff and spill over their banks in a free flowing flood. This happened in April of 1912 and March of 1939.

Intense convective thunderstorms commonly occur during warm seasons over the northern Great Plains of Montana. These thunderstorms can produce flash floods in many tributaries of the Milk River from May through September. Unusually heavy thunderstorms not only cause localized flash floods, but heavy rainfall can evolve into larger scale mainstem floods. These warm season floods can rise much more rapidly than spring floods. For example, in September of 1986, heavy thundershowers inundated Beaver and Alkali Creeks with 8 inches of rainfall. Storm water rushing down these drainages created a large flood in the Milk River mainstem. Similar thunderstorms in 1906, 1911 and 1921 produced 8 to12 inch rainfalls within 24 to 48 hours in the tributary basins of the Little Rockies and Bears Paws. Floodwaters inundated the mainstem Milk River during each of these events.

Photo courtesy of U.S. Army Corps of Engineers (USACE).

Ice jam flooding near Malta.

The term "100-year flood" may lead people to believe that it happens only once every 100 years. The truth is that an uncommonly big flood can happen any year. A 100-year flood is a flood event that is equaled or exceeded, on the average, once every 100 years. For any given year, there is a 1% chance that a 100-year flood will occur.

Photo courtesy of Valley County Pioneer Museum.

In March 1939, heavy spring rains combined with snowmelt to result in a free flowing flood.

What's A Floodplain?

Floodplains are the relatively flat areas bordering the banks of a watercourse that normally are dry, but become inundated when heavy rains, melting snow, ice jams or other conditions cause rivers and streams to overflow their banks.

—from *Managing Montana's Floodplains,* Montana DNRC.

Photo courtesy of Victor Wokal.

Warm season flooding near Glasgow in September 1986, was caused by heavy thundershowers.

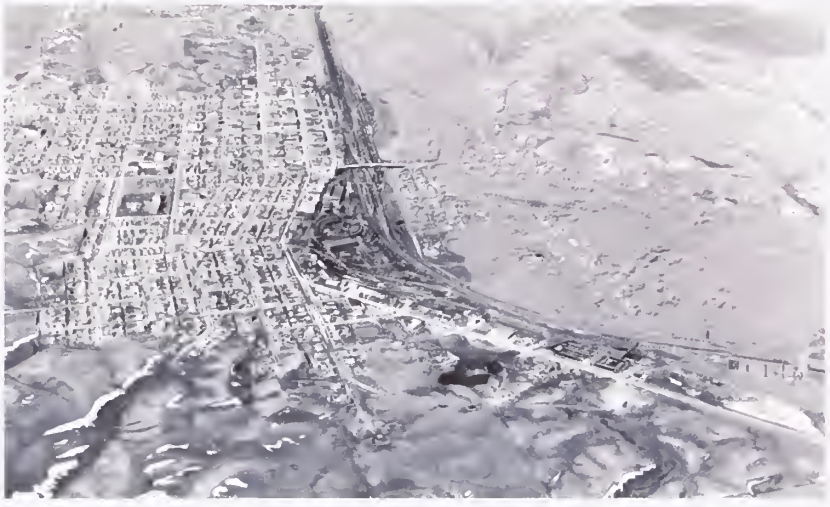
Damage from Milk River Floods

Milk River floods cover such a large area of floodplain for such a prolonged period, it is little wonder that the Milk River is referred to as the "biggest little river in Montana." Because of the river's low gradient, Milk River floods have a slow motion brutality that differs dramatically from the raging violence of foothill floods further west. Milk River floods tend to slowly engulf farms, trap livestock and surprise inattentive residents with bitterly cold high water. Floodwaters force residents from their homes and farms disrupting their lives and livelihoods. Flooded residents may be displaced for two or more weeks.

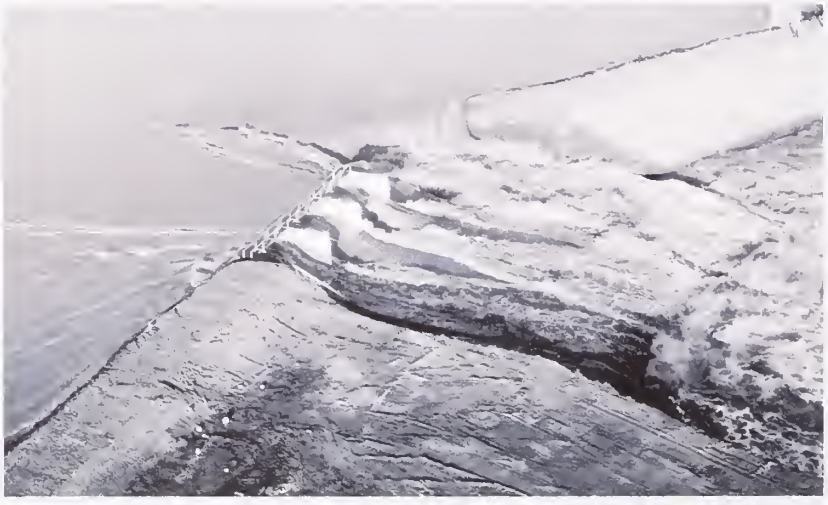
Floods may cause widespread residential damage, destroy roads and irrigation systems, and delay essential agricultural activities. Sixteen human fatalities have occurred due to flooding in the Milk River Watershed, a significant number considering the sparse population of the basin. Typically, flood victims were attempting to cross flooded roads and underestimated the deadly threat of the cold, slow moving, but powerful waters.

The relatively small number of homes and developments in the Milk River floodplain has minimized the number of structures lost or damaged by floodwaters. However, the Flood of 1952 was a notable exception. The Flood of 1952 is the flood of record for the Milk River Valley. April runoff from record winter snow accumulations caused severe flooding that extended the complete length of the Milk River and most tributary streams. This flood established the record *peak flow* and discharge figures for the Milk and many of its tributaries, and met or exceeded the 100-year flood values for Havre and all the communities downstream. Failure of the Frenchman dam contributed to the floodwaters at Glasgow and Nashua. The 1952 flood inundated the land for nearly three weeks in the Milk River Drainage. Damage estimates were placed at $6.6 million, which is equivalent to $44.1 million in 2001 dollars adjusted for inflation.

The Flood of 1952



The 1952 flood at Havre, Montana.



Photos courtesy of U.S. Army Corps of Engineers (USACE)

Failure of the Frenchman Creek dam contributed to the floodwaters at Glasgow and Nashua.

Photo courtesy of National Weather Service (NWS).

Floodwaters force residents from their homes, disrupting their lives and livelihoods.

If you live on the designated floodplain, the chances are about 1 in 2 that you will experience a flood during your lifetime.

Coping with Flood Events: Current Floodplain Management Programs

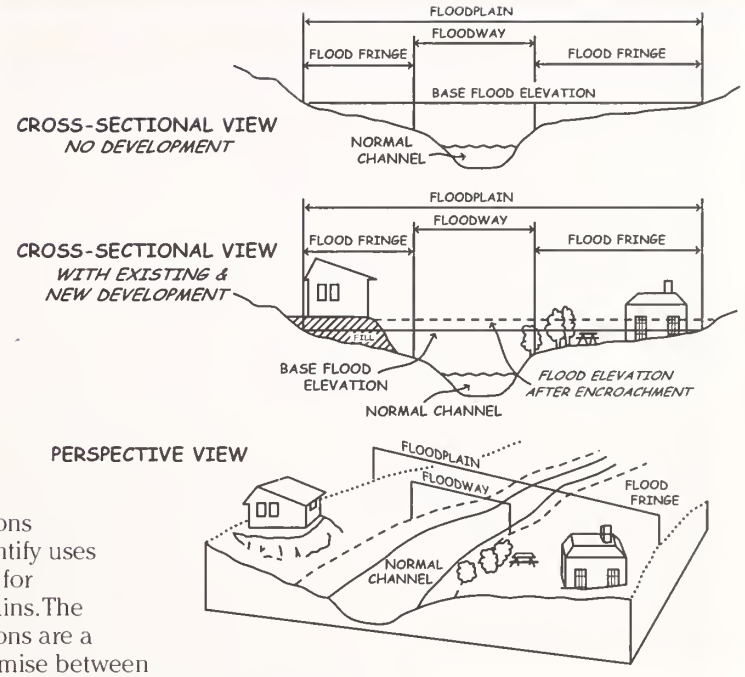
As time passes, there is increased pressure to build in the floodplain of the Milk River, thus increasing the need for wise floodplain management. Floodplain management is a decision-making process to attain wise use of floodplains. The purpose of floodplain management is to reduce the loss of life and property damage caused by floods. Floodplain management also aims to preserve and restore the natural resources and functions of floodplains (which, in turn, lessen damage potential).

The National Flood Insurance Program (NFIP) encourages the principles of floodplain management. Hill, Blaine, Phillips and Valley counties are each enrolled in the NFIP. In return for the availability of flood insurance, each county has agreed to adopt and administer a floodplain management program that manages new development in 100-year floodplains.

Flood insurance is available to all property owners through the NFIP, which is administered by the Federal Emergency Management Agency (FEMA). Prior to the NFIP, flood insurance was generally unavailable from the private sector and most state and local communities did not regulate floodplain development. Instead, flood control projects such as levees, dams, and channels were constructed to reduce flood damage. Despite the expenditures of billions of dollars for these projects, annual flood damage and disaster assistance costs escalated. In response, Congress created the NFIP in 1968 to reduce flood losses and disaster relief costs by guiding future development away from flood hazard areas where practicable, requiring flood-resistant design and construction, and transferring costs of losses to floodplain occupants through flood insurance premiums.

Each county has adopted the state minimum floodplain management regulations that identify uses suitable for floodplains. The regulations are a compromise between property rights, and the goal of limiting development to that which is minimally flood prone, and to that which will have a minimal impact on existing development.

100-Year Floodplain



To achieve the goals of floodplain management, counties take full advantage of all methods available to reduce residents' and communities' vulnerabilities to flood damages and to protect and enhance the natural resources and functions of the floodplain. This is achieved through floodplain management that entails:

- Avoiding the risks of the floodplain;
- Minimizing the impacts of those risks when they cannot be avoided;
- Mitigating the impacts of damages when they occur; and
- Accomplishing the above in a manner that both protects and enhances the natural environment.

If you live on the designated floodplain, chances are 1 in 2 that you will experience a flood during your lifetime. Although the effects of some floods can be lessened, since floods are part of the natural cycle of every river, they are a fact of life. Floodplain management is, therefore, vital to help citizens and communities avoid the ravages of floods or minimize their effects.

Information

Hi-Line Floodplain contacts
(See p. 40.)

Floodplain Management Section,
Water Operations Bureau, DNRC
PO Box 201601
Helena, MT 59620-1601
Phone: (406)444-0860

Federal Emergency Management Agency (FEMA),
Region VIII Mitigation Division
Denver Federal Center, Building 710
Box 25267
Denver, Co 80225-0267
http://water.usgs.gov/

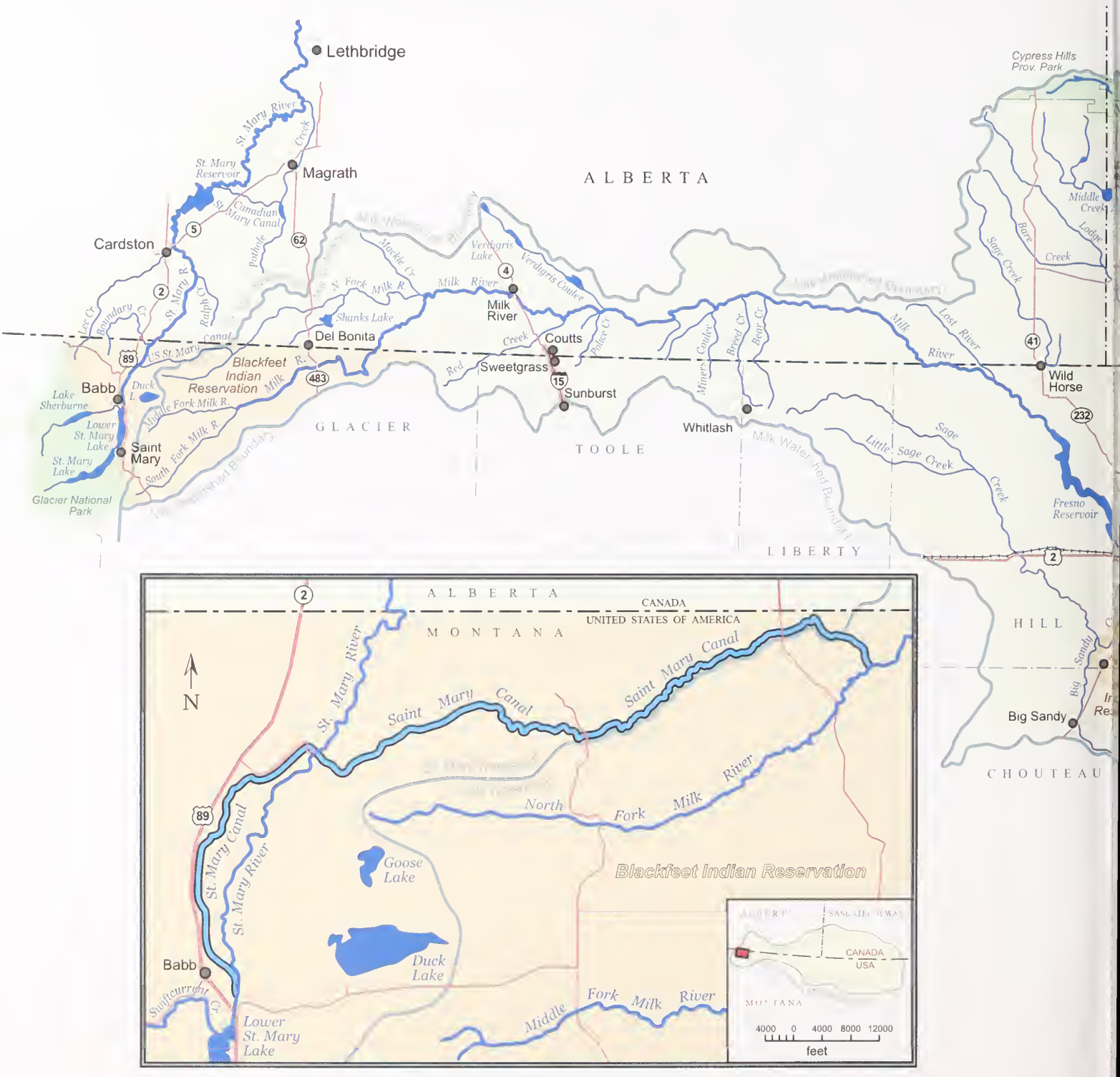
References

Managing Montana's Floodplains, Montana DNRC pamphlet. (406)444-6610

Montana Stream Management Guide, 1998 revised. Montana Department of Environmental Quality. (406)444-6610

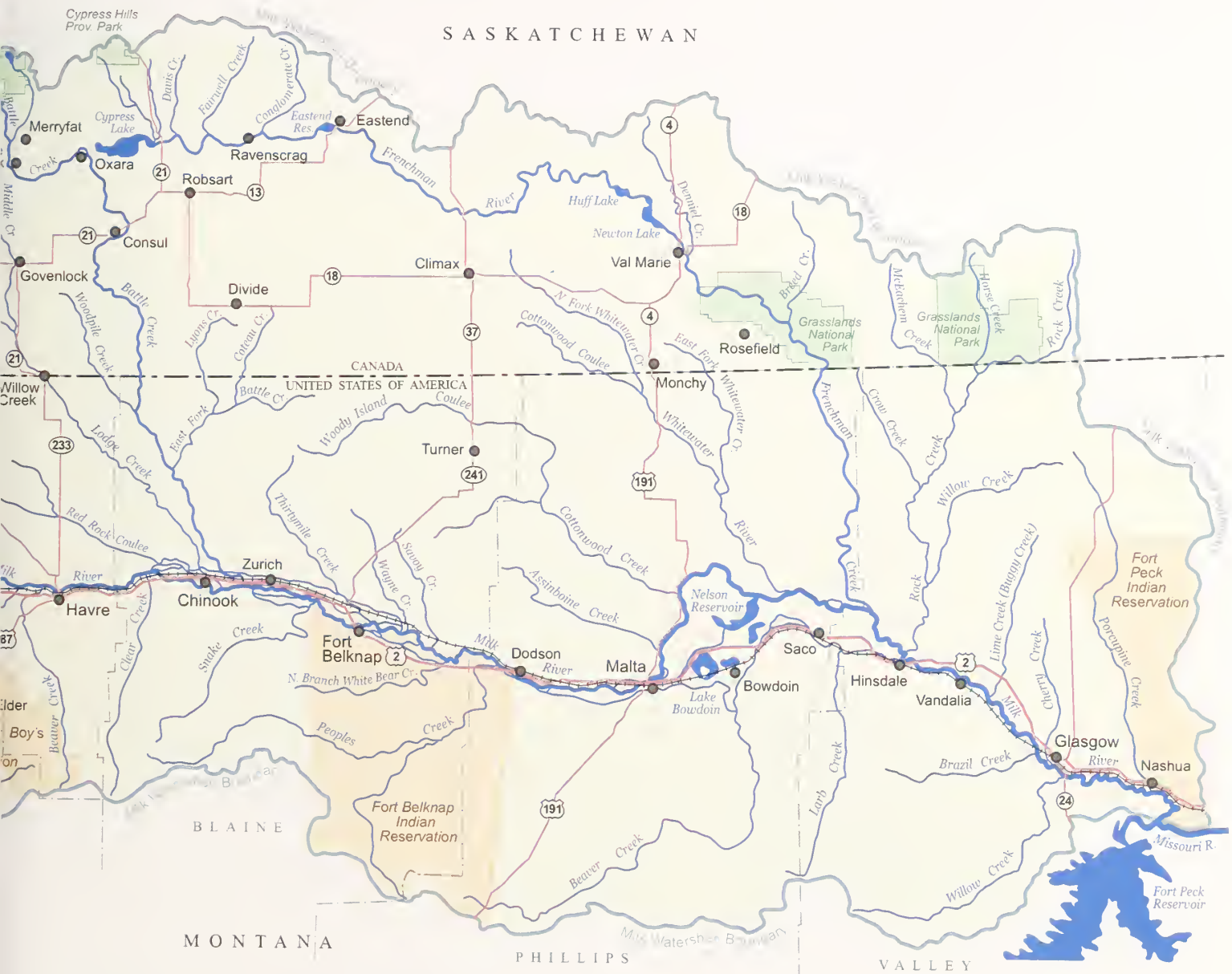
This chapter contributed by: Jim Rea, National Weather Service (retired) and Karl Christians, DNRC Floodplain Management.

The Milk River



St. Mary Canal (U.S.)

Watershed



Legend

- Watershed Boundaries
- Rivers
- Lakes and Reservoirs
- International Border
- Provincial Borders
- County Borders
- Indian Reservations
- Roads
- Railways
- Cities and Towns
- Parks

N

Kilometers
0 10 20 30
0 10 20
Miles

The Milk River Watershed is rich with varied habitats that support diverse fish and wildlife populations in a dynamic and complex ecosystem.

Chapter 7

Fish & Wildlife

A productive warm water river, the Milk's fishery resources vary considerably from the headwaters to the river's confluence with the Missouri.

Fishery Resources

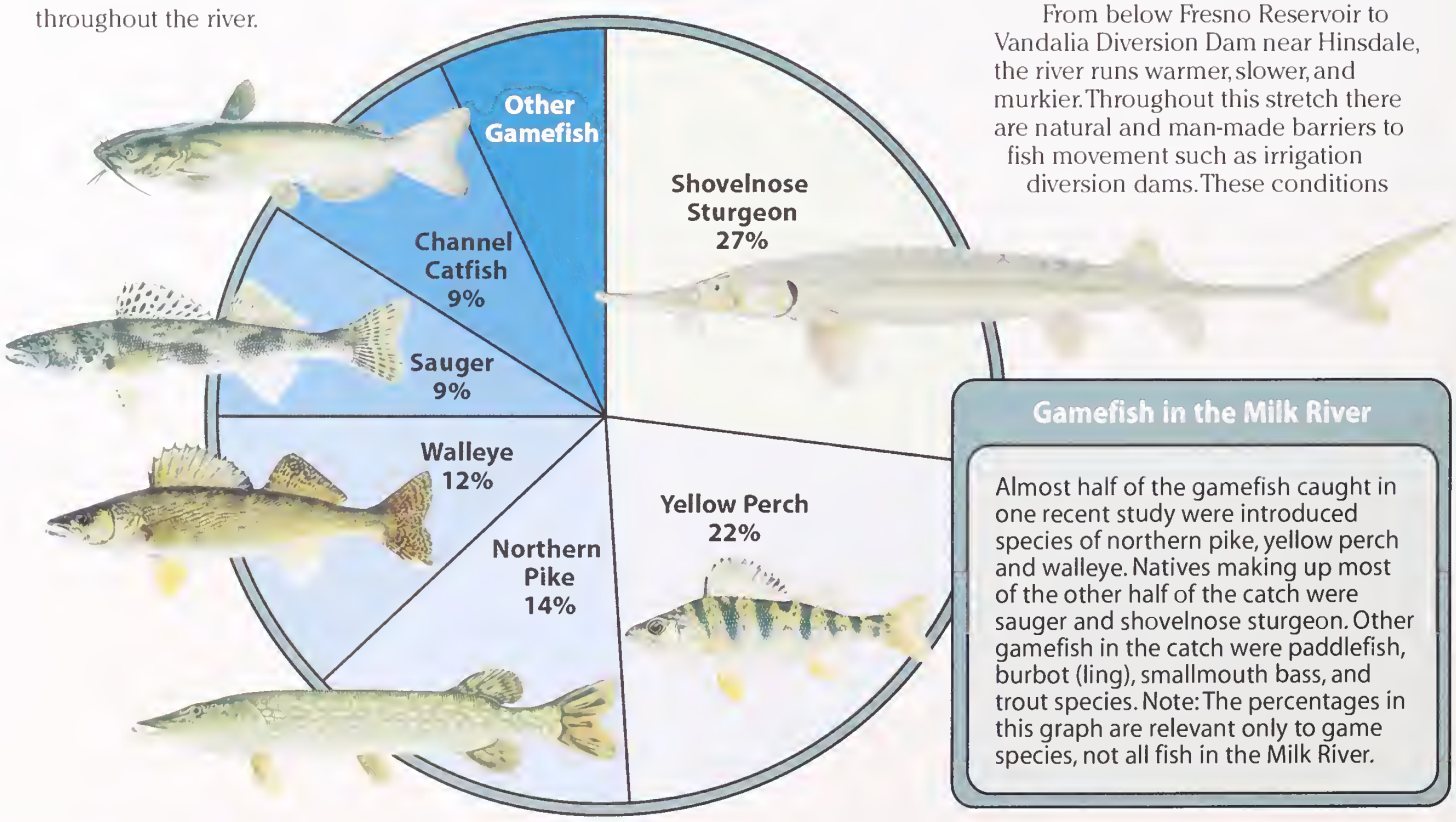
The Milk River and its tributaries support a great variety of warm-water fish species that differ with the changing elevations, habitat and water conditions along its course. Variations in river conditions create variable temperatures, turbidity and *velocity*. The river bottom is mostly sand and silt with occasional gravel and cobble, affording habitat ripe for aquatic invertebrates, including insects and plankton. Together these conditions support many different fish whose species composition varies by location. Only five species, flathead chub, Hybognathous species (western silvery minnow and plains minnow), northern pike, spottail shiner, and white sucker have been found throughout the river.

Twenty-eight native species and thirteen introduced species are known to inhabit the watershed, including twelve that were intentionally introduced to serve as game fish (northern pike, walleye, and yellow perch). Although these species are very popular among fishermen, they can compete with native populations. Native gamefish such as sauger, shovelnose sturgeon, and paddlefish also provide popular angling opportunities.

The most common fish in the Milk River Watershed are in the family Cyprinidae that includes chubs, carp, minnows, dace, and shiners. Suckers (Catostomidae) are also common. All eight of the sucker species in the river are native, and range in size from tiny to large.

The upper stretch of the river is characterized by cool, clear water running in shallow habitats. Unlike the river downstream of Fresno Reservoir, this fish community has a stronger component of native fishes (sauger and flathead chub) than the intermediate river sections that are bounded by dams. Immediately below Fresno Reservoir, cool water releases sustain a "put and take" trout fishery, stocked annually with rainbow and brown trout. This cool-water fishery extends only about one-half mile downstream, providing a rare opportunity for trout fishing.

From below Fresno Reservoir to Vandalia Diversion Dam near Hinsdale, the river runs warmer, slower, and murkier. Throughout this stretch there are natural and man-made barriers to fish movement such as irrigation diversion dams. These conditions



Gamefish in the Milk River

Almost half of the gamefish caught in one recent study were introduced species of northern pike, yellow perch and walleye. Natives making up most of the other half of the catch were sauger and shovelnose sturgeon. Other gamefish in the catch were paddlefish, burbot (ling), smallmouth bass, and trout species. Note: The percentages in this graph are relevant only to game species, not all fish in the Milk River.

Species of Special Concern

Of the native species found in the Milk River, blue sucker, paddlefish, pearl dace, and sauger are considered Species of Special Concern by the State of Montana; flathead chub and western silvery minnow are on the Montana Natural Heritage Program watch list. The Milk River may also be historic spawning habitat for the endangered pallid sturgeon, although this rare fish has not been found in recent samples.

Photo by Kent Gilge.

A fine day at Fresno Reservoir.

present challenges to native fish such as paddlefish, sturgeon, and sauger that are *migratory spawners.* Flow alteration has reduced the intensity of the spring flows that historically cued these fish to begin their migrations, and passage barriers restrict fish movement within this reach. Some species, particularly the non-natives like northern pike, carp, and spottail shiner, are able to fulfill their life cycles without migration and are, thereby, the dominant fish in this section.

The only section of the Milk River still available to fish from the Missouri River is the section from below Vandalia Diversion Dam to the confluence. More deep, slow habitat is available here, so this part of the river affords important spawning habitat for spring migratory spawners. This is the most diverse section of the river. Many of the species in the upper reaches of the river are found here, in addition to spring spawners like the unique and odd-looking sturgeon and paddlefish.

Two types of sturgeon inhabit the murky waters of the Missouri River, the endangered pallid sturgeon, and the more common shovelnose. Sturgeon evolved over 70 million years ago and their dinosaur-like appearance earned them a reputation as the 'ugliest fish in North America.' Sturgeon live in larger rivers like the Missouri, and may migrate up into tributaries like the Milk to spawn during high spring flows. The pallid sturgeon has a flattened shovel shaped snout, a white underbelly and a long reptile-like tail. Their toothless mouth is on the bottom of a flattened shovel-shaped snout. Sturgeons do not actively pursue live prey, but use their large mouths to vacuum food from the bottom of the river.

The paddlefish or "spoonbill catfish" lacks scales and has two small barbels, or whiskers, near its mouth. Its long paddle-shaped snout distinguishes it from all other fish. Sometimes exceeding 100 pounds, it is one of the most peculiar fish in North America. It has no teeth and feeds by swimming through the water with its huge jaws open, filtering microscopic plants and animals through many fine gill-rakers. Paddlefish, too, make spawning runs up the Milk from the Missouri River. These spring spawning runs provide a unique opportunity for anglers, who must snag their prey since paddlefish do not "bite" bait.

Reservoir Fisheries

Fresno and Nelson are the two reservoirs within the mainstem system of the Milk River. These manmade lakes are U.S. Bureau of Reclamation projects, originally created for irrigation water storage. They have been developed as sport fisheries through cooperation with Montana Department of Fish, Wildlife, and Parks. Both of these reservoirs are subject to severe water fluctuations and fish populations vary from year to year depending on available habitat.

Fresno Reservoir is located on the Milk River 14 miles west of Havre, Montana (see map pp.22-23). To provide additional water supply in the Milk River, water is moved from the St. Mary river basin near Glacier National Park to the North Fork of the Milk River, and is then stored in Fresno Reservoir. Fresno was originally stocked with rainbow trout in the 1940s, but they did not survive very well. Walleye were stocked beginning in the 1960s and, soon after, pike were found there, too. They are thought to have made their way to Fresno from the St. Mary drainage, which is the only drainage in Montana where they are a native species. In addition to game fish, Fresno has also been stocked with emerald shiners, yellow perch, and spottail shiners to provide forage. Fresno is currently a walleye, northern pike, and yellow perch fishery, and fishing can be quite good in years of ample water. Live bait is prohibited in Fresno and in the river upstream of it due to an agreement with Canada, to prevent the additional introduction of non-native species into their waters. Montana Fish, Wildlife, and Parks manage the area immediately below Fresno for a fishing access site, and an active chapter of Walleyes Unlimited is just one group that enjoys fishing the lake.

Nelson Reservoir is an off-stream storage reservoir near Malta, Montana that is filled with Milk River water that is diverted near Dodson and transported to the lake via the Dodson North canal (see map p.11). Nelson was originally stocked in the 30's with largemouth bass, then crappie and trout. Eventually walleye, northern pike, and yellow perch were planted in the lake, resulting in a productive sport fishery. Spottail shiners have been stocked to provide forage for these predators. Northern pike thrive in the lake. Ice fishing is very popular at Nelson with catches of northern pike up to 20 pounds and 1 pound perch fairly common through the ice.

Photo by Luke Vickrey, Havre Daily News.

A rainbow shines over Beaver Creek Reservoir.

Riparian areas and wetlands along the shores of the river provide cover and breeding habitat for many wildlife species. Prairie potholes and mixed grass prairie of the uplands afford other types of habitat important to mammals, birds, reptiles and amphibians.

Milk River Wildlife

The Milk River Watershed was once home to large herds of bison, elk, deer, and pronghorn; and predatory species like grizzly bears, mountain lions, and wolves. Human settlement in the basin led to declining numbers of some species, yet many mammals adapted to the changes and still thrive in the region. Bison are still present on several of the Indian reservations throughout the Milk River region. In the western portion of the drainage near Glacier Park, elk, wolves, mountain lions and grizzly bears are frequent residents. Further east, pronghorn, white tail and mule deer populations remain strong, making the area a popular hunting destination. Smaller mammals are also abundant in the watershed including: red fox, coyotes, bobcats, beavers, muskrats, cottontail rabbits, jackrabbits, black tailed prairie dogs, badgers, mink, weasels, raccoons, porcupines, skunks and seven bat species.

Habitat diversity provides a hospitable place for many bird species, making the watershed a haven for songbirds, shorebirds and waterfowl. Over 150 species of non-game birds can be seen over the course of the year. Numerous game species are also found including ring-necked pheasants, sharp-tailed grouse, sage grouse, mourning doves, Canada geese, and several duck species. Birds of prey—bald eagles, golden eagles, ferruginous hawks, great horned owls and peregrine falcons—also use the area throughout the year.

Reptiles and amphibians are another crucial part of the Milk River ecosystem and varied habitats provide for a multitude of species. Reptiles found in the area include western painted turtles, soft shelled turtles, prairie rattlesnakes, bull snakes, short horned lizards, and garter snakes. Amphibians found in the abundant wetland and riparian areas include western chorus frogs, leopard frogs and Woodhouse's toads.

Photo by Bob Gurr, courtesy of Grasslands National Park of Canada.

Sage grouse.

Prairie Pothole Wetlands

Prairie pothole wetlands occur throughout the Milk River Basin. Created when glaciers receded and the last ice age ended, these wetlands provide the most productive breeding habitat for waterfowl and many other birds in North America. A total of 177 bird species breed in the prairie pothole region of the United States and Canada, including 20 species of waterfowl, 36 water birds, 49 migrant neo-tropical songbirds, 47 resident songbirds, 17 raptors and eight upland game birds.

Potholes help to reduce flooding by trapping spring run-off, recharge groundwater aquifers and improve the overall water quality of the Milk River system. They are also enjoyed by many outdoor recreationists, including hunters and bird watchers.

Studies indicate that Montana has lost 27% of its prairie pothole wetlands and 50% of its native grasslands. The loss of potholes can increase flood damage and effectively reduce bird populations. Loss of grasslands has resulted in an increase in predation. In areas with poor grass cover, predators can destroy up to 95% of all duck nests. These facts suggest that safeguarding prairie potholes and grasslands in the Milk River Watershed is vital for the wildlife that depends on them.

Bowdoin National Wildlife Refuge

Bowdoin Wildlife Refuge, about seven miles east of Malta, is a significant resting area for waterfowl migrating from wintering grounds in Mexico and South America to breeding grounds in Canada. Known for its colonies of nesting birds, it is managed primarily for ducks and geese. The 15,551 acre refuge was established in 1936 and is managed today by the U.S. Fish and Wildlife Service. A system of dikes and ditches regulates water levels. The diverse water and land habitats there include shortgrass prairie, shrub lands, grassy marshes and wetlands. The area provides a safe staging area for up to 100,000 ducks during the fall migration. The islands and marshes in Lake Bowdoin provide important nesting habitat for white pelicans, least terns, piping plovers, great blue herons, American bitterns, black-crowned night herons, white-faced ibis, grasshopper sparrows, savannah sparrows, and several waterfowl, shorebird and songbird species. Other species found there are Franklin's gulls, eared grebes, double-crested cormorants, and California and ring-billed gulls. Upland nesting birds present include Sprague's pipit, Baird's sparrow and chestnut-collared longspur. To insure a sustained water supply to the refuge, the Fish and Wildlife Service contributed funds toward the construction of Fresno Reservoir in exchange for a water right of 3,500 acre feet from the Bureau of Reclamation's Milk River system. This water and spring runoff supports the wildlife refuge's excellent bird habitat.

Photo by Dave McArthur, courtesy of Grasslands National Park of Canada.

Hillside in the mist with mule deer fawn.

Photo courtesy of U.S. Fish and Wildlife Service.

Tundra swans on Lake Bowdoin.

Photo by Bob Gurr, courtesy of Grasslands National Park of Canada.

Pronghorn herd in winter at Grasslands National Park of Canada.

Vital Grasslands in the Milk River Watershed

Much of the tall grass prairie that used to characterize the Great Plains was converted to agricultural production over the past century. One unforeseen consequence has been the reduction of tall grass prairies into fragments. Studies over the last several decades show steeper population decreases among grassland nesting birds than any other North American bird species, and this alarming trend has been linked to loss of grassland habitat. In the Bitter Creek-Frenchman Creek portion of the Milk River Watershed, however, a "Biological Survey of a Prairie Landscape in Montana's Glaciated Plains" by the Montana Natural Heritage Program revealed that large intact prairie communities can still be found.

The grasslands support Sprague's Pipit, Baird's sparrow, Grasshopper Sparrow, McCown's Longspur and Chestnut-collared Longspur—all Montana Species of Concern. The presence of a mosaic grassland structure (in both density and height) provides the foraging and nesting habitat that each of these bird species require. Five amphibian and seven reptile species were also documented in the study area, including Great Plains Toad, Boreal Chorus Frog, Northern Leopard Frog, Painted Turtle, Racer, Plains Garter Snake, and Western Rattlesnake. Wildlife residents noted by the study included two active Black-tailed Prairie Dog colonies, and a renewed Swift Fox population (following releases in Canada over the past decade).

"Climate, soil, and geomorphic process have created a highly variable landscape with diverse vegetation pattern and structure, which provide valuable wildlife habitat. Many portions of the area support high quality natural vegetation with a complete suite of grassland birds."

The study called this region the "largest remaining intact grassland north of the Highline in Montana," concluding that it "stands out as one of the most extensive naturally functioning glaciated plains grasslands in North America."

The Dry Fork Creek landscape is especially noteworthy for its extensive, intact tracts of northern porcupine grass, which make the area "one of the best—if not the best—stands of its type documented in all of the U.S. Great Plains." This important grassland area occupies most of a large block of school trust lands managed by the Montana Department of Natural Resources and Conservation and leased for grazing. The study concluded:

"The state and private lessee have maintained this notable grassland through good stewardship practices. Livestock grazing is highly compatible with natural ecological processes that maintain these grasslands, whereas plowing the grassland for agricultural production would result in a permanent loss of this important grassland."

Information & Resources

Montana Department of Fish, Wildlife & Parks

Region 6

Route 1-4210
Glasgow, MT 59230
(406)228-3700
FAX: (406)228-8161
fwprg62@state.mt.us

Havre Area Resource Office

2165 Hwy 2 East
Havre, MT 59501
(406)265-6177
FAX: (406)265-6123
fwphao2@state.mt.us
http://www.fwp.state.mt.us/contact/

Bowdoin National Wildlife Refuge

HC 65, BOX 5700
Malta, MT 59538-9609
Telephone: (406)654-2863
E-mail: R6RW_BWD@fws.gov
http://mountain-prairie.fws.gov/refuges/bowdoin/bowdoin.htm

Montana Partners for Fish and Wildlife

US Fish & Wildlife Service
922 Bootlegger Trail
Great Falls, 59404-6133
Telephone: (406)727-7400

Future Fisheries Program

Montana Dept. of Fish, Wildlife & Parks; Fisheries Division
Helena (406)444-2449

Montana Natural Heritage Program

Montana State Library, Helena
(406)444-5354
http://nhp.nris.state.mt.us

This chapter contributed by:
Susan Camp, Fisheries Biologist, Bureau of Reclamation;
Justin Kucera, Wildlife Biologist, Bureau of Reclamation.

Chapter 8

Recreation

Photo by Kent Gilge.

The Milk River Watershed is blessed with numerous recreational opportunities. On both sides of the international divide (49th Parallel) county, state, provincial, interprovincial, national and international parks afford outdoor settings for hiking, picnicking, sight-seeing, and other forms of recreation. Fishing and boating make Fresno and Nelson Reservoirs in Montana and Cypress Lake Reservoir in Saskatchewan popular. Bowdoin and Black Coulee National Wildlife Refuges; Chain of Lakes Fresno Wildlife Management Area, and private lands under Montana's block management program offer a variety of bird and game prospects for the avid hunter.

Historic Sites and Parks

Historic sites and parks abound on both sides of the 49th parallel in the Milk River Watershed. In southern Alberta, for example, Writing-on-Stone Provincial Park includes an archeological preserve; a reconstructed Northwest Mounted Police outpost; and some of the largest protected prairie areas in Alberta. In neighboring Saskatchewan, Grasslands National Park occupies two separate blocks of land that protect prehistoric badlands; one of the largest sections of undisturbed mixed-grass prairie in North America; Plains Indian teepee rings and artifacts; and the only colony of black-tailed prairie dogs in their native habitat in Canada (see map pp.22-23).

Spanning the provincial border, Cypress Hills Interprovincial Park protects some of the most unusual prairie ecosystems north of the 49th Parallel, which may explain why it is Canada's only interprovincial park. At nearby Fort Walsh National Historic Site visitors learn why the area was called 'Whoop-Up Country.' Visitors also discover how the 1873 Cypress Hills Massacre led to creation of the North West Mounted Police.

Across the border in Montana, Beaver Creek County Park (south of Havre) provides over 10,000 acres of camping, hiking, fishing and biking at one of the largest county parks in the United States. Beaver Creek, Bear Paw Lake and Lower Beaver Creek Lake are popular fishing and camping areas. Bird watching and wildlife viewing are popular activities for picnickers in the summer. Winter recreation in the park includes ice fishing, cross country skiing, snowshoeing, sledding and some snowmobiling.

Sixteen miles south of Chinook, Montana, the Bears Paw Battlefield is a tragic reminder of the Nez Perce Indian Tribe's defeat in 1877. After an 1170 mile pursuit that began in Joseph, Oregon, Chief Joseph and the few remaining Nez Perce surrendered to the U.S. Cavalry after both sides suffered high casualties. Blaine County Museum in Chinook serves as the interim National Park Service Visitor Center.

Fishing, Boating, and Other Water Sports

A number of reservoirs and lakes in the Milk River Watershed provide important water storage and flood control, plus a wide variety of recreational opportunities. From sauger above Fresno reservoir, to trout just below the dam, to the prehistoric 'monsters' of the lower river, the Milk River hosts a great variety of fish species, introduced and native, for the angler or the naturalist to enjoy.

Fresno Reservoir (13 miles west of Havre) is one of Montana's best warm water fishing spots. Swimmers, boaters, water skiers and campers also frequent the 25 mile long man-made lake. Downstream and seventeen miles from Malta lays Nelson Reservoir, the number one walleye spot in Montana. There happy anglers catch fish of record-breaking sizes. This 4000 acre lake also provides superior ice-fishing opportunities in winter.

North of the international border, Cypress Lake in Saskatchewan is an important water storage facility for agricultural producers (see map pp.22-23). More recently, it has become a popular recreational area and an important fall staging area for waterfowl.

Photo courtesy of USDA-NRCS.

Bear Paw Lake at Beaver Creek County Park south of Havre.

Photo by Luke Vickrey, Havre Daily News.

Ice fishing in Beaver Creek Lake.

Wildlife Viewing and Hunting

Opportunities to observe and hunt wildlife abound in the Milk River Valley on both sides of the 49th Parallel. In Montana, Bowdoin National Wildlife Refuge is a welcome spot for more than 250 species of birds. Birdwatchers come to observe the nesting colonies of black-crowned night heron, white-faced ibis, and American white pelicans. Visitors learn that late spring, early summer and late fall are the best times to view these birds. Hunters appreciate the fall hunting season.

Across the international border, Grasslands Park's East and West Blocks, offer one of the largest pieces of undisturbed mixed-grass prairie habitats in North America. Visitors there may come across reptile and mammal species rarely found elsewhere: yellow-bellied racers and black-tailed prairie dogs still reside in their native habitats.

In Montana, most of the land in Hill, Blaine, Phillips and Valley Counties is held by private landowners. These private lands are also home to numerous wildlife and birds of interest to sportsmen. Mule and whitetail deer, antelope, sharptail and sage grouse, pheasants, and waterfowl are found throughout the valley. Montana's Block Management Program, a cooperative effort between private landowners and the Montana Department of Fish, Wildlife and Parks, gives the public free hunting access to private lands in the Milk River Watershed, and some adjacent public lands. Landowner participation in Block Management Areas (or BMAs) is voluntary and BMAs are only available for fall hunting. Contracts are negotiated in the spring and summer, so changes in BMAs may occur from year to year.

Landowner participants in the block management program are given incentives in return for providing free public hunting on their properties. By August 15 every year, a brochure is prepared that describes current BMA locations, what each offers and how hunters can obtain permission. Each BMA has specific rules that hunters must be aware of and adhere to after receiving permission to hunt in a BMA.

Other Recreation Opportunities

Space prohibits further description of the myriad recreation opportunities in the Milk River Watershed, so a brief list of other popular spots and activities is provided below.

- Blaine County Museum, Chinook, MT
- Bear Paw Ski Bowl
- Old Forts Trail (from Fort Benton to Fort Walsh in the Cypress Hills)
- Havre Beneath the Streets
- Hill County H. Earl Clack Museum (Havre)
- Ft. Assiniboine Historic Site (southwest of Havre)
- Sleeping Buffalo Hot Springs
- Black Coulee National Wildlife Refuge (North of Dodson, MT)
- Phillips County Museum (Malta)
- Museum of the Plains Indians (Browning, MT)
- Valley County Pioneer Museum (Glasgow)

Photo by Wayne Lynch, courtesy of Grasslands National Park of Canada.

The Frenchman River valley in the East Block of Grasslands National Park of Canada.

Information & Resources

Alberta Recreation and Travel
www.discoveralberta.com

Beaver Creek Park Office. Inquiries, information requests and reservations (406)395-4565

Bear Paw Battlefield Tours. Contact the National Park Service Site Ranger at (406)357-3130 or Blaine County Museum at (406)357-2590

Blaine County Museum
(406)357-2590

Block Management Program in Region 6, Montana Department of Fish, Wildlife and Parks:

www.fwp.state.mt.us/hunting/blockman/region6.asp

Glasgow Office (406)228-3700

Havre Area Office (406)265-6177

Cypress Hills Interprovincial Park.
In Alberta (403)893-3777; in Saskatchewan (303)662-4411

Ft. Walsh National Historic Site
(306)662-2645

Glacier National Park. For general information
(406)888-7800 or
www.nps.gov/glac

Grasslands National Park
(306)298-2257

Havre Chamber of Commerce
(406)265-4383

Hill County H. Earl Clark Museum
(406)265-4000

Malta Chamber of Commerce
(406)654-1776

Montana Travel:

Montana's Missouri River Country
www.missouririver.visitmt.com
or 1-800-653-1319

Russell Country
www.russell.visitmt.com
or 1-800-527-5348

Phillips County Museum (Malta)
(406)654-1037

Valley County Pioneer Museum (Glasgow) (406)288-8692

This chapter contributed by: Mary Ellen Wolfe.

"For society to progress, decisions must be made that recognize and respect the requirements and rights of future generations, as well as the requirements and intrinsic value of all species and the Earth's carrying capacity with respect to its human population." –Chris Maser

Chapter 9

Education & Citizen Involvement

The Big Picture

Water sustains biological life. Most of the Earth's surface area is water, as are our bodies. Water unites us; it is the common thread woven throughout our daily lives. Growing populations, industry, agriculture, and wildlife place ever increasing pressure on this vital compound. We are pushing both the quantity and quality of water to limits never before known. Where do individuals fit in this very large, complex web? How can each of us do our part to maintain abundant and high quality water resources to support future generations?

The Local Scene

Across the United States, many citizens are taking more active roles in local natural resource planning. By being involved, they are learning more about their local land and water resources. Organizations and government agencies now turn increasingly to local people for help addressing shared issues of concern. In Montana alone, there are over 40 locally-led watershed planning groups made up of citizens committed to working together for a better environment and quality of life. Through their efforts these citizens are shaping their own lives, for they have the most to gain or lose. Local ownership of local problems is the catalyst for positive group decision making. The Milk River International Alliance (MRIA) is a good example.

The Milk River International Alliance

The MRIA fosters collaborative solutions to natural resource issues to improve the quality of life and understanding of resource management in the Milk River Basin. It was created as an outgrowth of a locally led watershed education initiative which conducted the "Milk River: International Lifeline of the Hi-Line" workshop in Havre, Montana, on January 30, 1999. Attended by over 200 U.S., Canadian, and Native American citizens, the workshop explored many of the complex water management issues which basin residents face in the 21st Century. Collaboration and coordination were a constant theme at the workshop as the key to improved water management. After the workshop, shared interest in creating a locally led initiative for the basin prompted the creation of the MRIA on March 24, 1999.

Membership in the MRIA is open to U.S., Canadian, and Native American basin residents who wish to participate. The MRIA is founded on the premise that, working together, all interested residents can contribute to the goal of ensuring healthy land and water in the Milk River Watershed for present and future generations. In sum, the MRIA is working to become a positive voice for effective management and enhancement of the resources in the Milk River Basin.

Is It Time for You to Get Involved?

Are you willing to get involved and participate in natural resource decision making? Do you need to know more? Education is a great place to begin. Involvement can take many forms: Do you let the faucet run while you brush your teeth? Does it make any difference? Do you pour your used motor oil down the storm drain in your community? Are you a member of irrigation or conservation district board of supervisors? Are you involved with the Milk River International Alliance?

Each of us has a different comfort level, but the important idea is to become educated and become involved. Giving your opinions, ideas and resources often benefits others. And working collaboratively may broaden your horizons. If you don't know where to begin, the following is a list of groups within the Milk River Watershed that may spark your interest.

Photos this page by Luke Vickrey, Havre Daily News.

Walleyes Unlimited is one of the organizations that provides opportunities to get involved. Above: Members of the Fresno Chapter hold an event at Fresno Reservoir that also includes boat rides, fish identification and water safety workshops for students from schools along the Hi-Line. At left: Stan Huhtala, Bureau of Reclamation, unloads wave whackers as part of an improvement project by Walleyes Unlimited.

Where to Get Involved

Local Conservation Districts
In Valley, Phillips, Blaine, Hill, and Liberty Counties; the Big Sandy Conservation District; and Tribal Districts on the Fort Belknap and Rocky Boy's Reservations. Most districts are listed in the local phone directories or can be reached through local Natural Resources Conservation Service offices (see pp. 40-41 for detailed contact information).

Local Irrigation Districts
Of Blaine, Phillips and Valley Counties: Alfalfa Valley, Harlem, Dodson, Malta, Fort Belknap, Paradise Valley, Glasgow, and Zurich. Milk River Joint Board of Control (see pp. 40-41 for detailed contact information).

Milk River International Alliance
An international watershed organization for the Milk River Basin. Contact the Blaine County Conservation District for an Alliance representative (see pp. 40-41 for details).

Pheasants Forever
Habitat improvement organization. Contact the organization for a list of local chapters and representatives. Dan Hare (Montana and North Dakota representative), 315 Tucson Avenue, Bismarck, ND 58504; Telephone (701) 250-9921 or email: danhare@bis.midco.net.

Ducks Unlimited
Habitat improvement organization. Contact the state organization for a list of local chapters and representatives. Bruce Posey, PO Box 1416, 2823 6th Ave. North, Billings, MT, 59101-1416; Telephone: (406)252-0551 or email: bposey@streeterbros.com.

Walleyes Unlimited
Habitat improvement organization. Several local chapters are available across the Hi-Line. The organization is also available on the web at http://www.walleyesunlimited.com/.

State Agencies
Involved in resource planning: Department of Natural Resources and Conservation; Montana Department of Environmental Quality; Montana Department of Fish, Wildlife & Parks (see pp. 40-41 for detailed contact information).

Federal Agencies
Involved in resource planning: Bureau of Land Management - Glasgow, Malta and Havre; U.S. Fish and Wildlife Service (Bowdoin National Wildlife Refuge) - Malta; United States Geological Survey - Fort Peck; International Joint Commission located with USGS - Helena; Natural Resources Conservation Service - Glasgow, Malta, Fort Belknap, Chinook, Havre, Rocky Boy's, Big Sandy, Chester, Cut Bank, and Browning; Bureau of Reclamation - Billings; Bureau of Indian Affairs - Fort Belknap Agency, Blackfeet Indian Agency, Rocky Boy's Agency, and Fort Peck Agency.

Canadian Resource Agencies
Alberta Environment and the Saskatchewan Watershed Authority are key points of contact (see p. 14 for details).

Tribal Governments
Of the Blackfeet Indian Nation (Browning); Chippewa Cree Tribe (Rocky Boy's); Fort Belknap Indian Community (Fort Belknap); and Fort Peck Tribes (Poplar) are actively involved with natural resources planning. They generally have natural resources and/or water resources departments who preserve and improve tribal natural resources (see pp. 40-41).

Reference
Chris Maser. *Resolving Environmental Conflict Towards Sustainable Community Development.* Delray Beach, FL; St. Lucie Press, 1996.

This chapter contributed by: Dale Krause, NRCS.

A Recipe for Satisfying Diverse Water Needs?

Chapter 10

Water Conservation

Water conservation. We hear these words in the media, at school, in public meetings, or at home. But does water conservation have any value for residents of the Milk River Watershed? What is the potential for water conservation in residential and agricultural settings? Are there benefits from conserving water? In an area of unpredictable water supplies, water conservation deserves special attention.

A short definition of water conservation is maximizing the efficiency of water use. Though specific water conservation practices may vary, depending on the setting, (residential or agricultural), the results are the same. Water conservation practices can mean:

- Reduced costs for water supplies;
- A more reliable water supply;
- Stored water for times of drought;
- Improved water quality.

Let's recall how water supplies are currently used in the Milk River Watershed to see why there might be opportunities to realize some benefits from water conservation. The journey for Milk River water begins near Glacier National Park and the Blackfeet Indian Reservation, it then travels through Canada, before looping southward back into the United States. The water's journey ends many miles to the southeast–at the confluence with the Missouri River near Nashua. From start to finish, Milk River water gets used and reused and reused. Over and over again, the river is tapped to satisfy the thirst of municipalities, agriculture, recreationists, fish, wildlife and others.

Havre, for example, diverts water from the Milk River; distributes it to city residents for domestic uses (showers, laundry, cooking, etc.); treats the water at the wastewater treatment facility; and then returns it to the Milk River. As it moves downstream, other communities, farmers and ranchers divert the same water for their needs—irrigation, stockwater, household use. Water not used by one person, may be used by another person downstream. This pattern repeats itself over and over until the water reaches the confluence with the Missouri River.

Residents who depend on the water of the Milk River realize that periodic water shortages are all too common. This can be painfully apparent in times of prolonged drought. In such times, concerns emerge about whether there's enough water in the Milk to meet all the needs. Would water conservation ease the pinch? What water conservation practices might be useful?

From a broad perspective, several possible options for addressing watershed-wide shortages in the Milk River are sometimes considered:

- Implementing cost-effective water conservation measures;
- Developing additional supplies;
- Increasing water transfers from the St. Mary River drainage;
- Retirement of some irrigation lands.

Each of these options has advantages, disadvantages, and associated costs, and all of the benefits and costs must be considered for each alternative. Numerous studies have shown, however, that the need for and cost of one of these options—developing additional water supplies—is greatly reduced by water conservation practices.

Simple Practices Make A Difference

On an individual scale, every water user needs to look at their potential for using water conservation practices, depending on their situation. It's worth taking the time to do. If each water user practiced water conservation, the cumulative benefits for you and your neighbors could be improved water quality, and reduced operational and development cost for municipalities, irrigation systems, and residences!

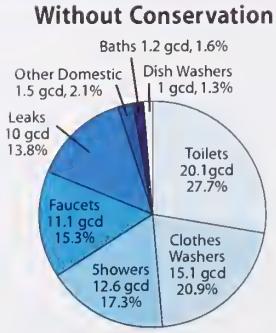
Simple water conservation measures can have quite an impact for municipal water users. Repairing leaky faucets or toilets, and restricting lawn watering to early morning and evening hours can yield significant water savings at little cost to the homeowner. Other water conservation actions with large water savings include the installation of low flow showerheads and low flow toilets and replacing landscaping with less 'thirsty' native plants. Though the initial cost of some of these items may be expensive, the long-term returns—in water and energy savings—can offset the costs.

Typical Single Family Home Water Use

Studies show that dripping faucets and leaking toilets account for as much as 14% of all indoor water use, equivalent to 10 gallons (38 liters) per person of water lost per day.

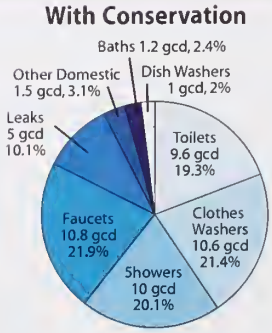
Source: WaterWiser - The Water Efficiency Clearinghouse

Without Conservation


Baths 1.2 gcd, 1.6%
Other Domestic 1.5 gcd, 2.1%
Dish Washers 1 gcd, 1.3%
Leaks 10 gcd 13.8%
Toilets 20.1gcd 27.7%
Faucets 11.1 gcd 15.3%
Clothes Washers 15.1 gcd 20.9%
Showers 12.6 gcd 17.3%

Total: 72.5 gallons per capita per day (gcd)

With Conservation


Baths 1.2 gcd, 2.4%
Other Domestic 1.5 gcd, 3.1%
Dish Washers 1 gcd, 2%
Leaks 5 gcd 10.1%
Toilets 9.6 gcd 19.3%
Faucets 10.8 gcd 21.9%
Clothes Washers 10.6 gcd 21.4%
Showers 10 gcd 20.1%

Total: 49.6 gallons per capita per day (gcd)

Improving Agricultural Water Use Efficiencies

Agricultural water users also have a variety of opportunities to maximize water use efficiency. Some measures are relatively inexpensive, but require lots of work. Others may require a large financial investment. For example, simple farming practices like reducing irrigation set times; implementing a soil moisture monitoring and irrigation scheduling routine; and monitoring the amount of water applied per irrigation can achieve comparatively inexpensive improvements in water use efficiency. The major cost of such efforts is the human time and energy needed to make more frequent irrigation set changes, and increase monitoring of applied water and soil moisture conditions. There are also some technological tools, like AgriMet, the agricultural meteorology network computerized soil moisture monitoring, and the Paul Brown moisture probe, that help water users conserve irrigation water. Local Extension and NRCS offices can provide more information.

Other on-farm efficiency improvements include such measures as land leveling, utilizing gated pipe systems, employing surge irrigation techniques, and utilizing low pressure sprinkler irrigation systems. While the initial investment in these types of efficiency improvements is generally higher, the long-term return may make them worth considering. Before investing in these types of improvements, producers are wise to evaluate each option carefully.

Numerous conservation measures should be considered for large water distribution or conveyance systems like those owned by irrigation districts and private irrigators. Here are a few:

- Maintenance of the canals and laterals to keep them free of obstructions, like silt and plant growth;
- Implementing a good water measurement and accounting program to keep track of water within the conveyance and canal systems;
- Implementing an incentive based rate structure based on water deliveries;
- Site specific canal lining projects;
- Conversion of high seepage laterals to buried pipe systems.
- Local water banking to allow district members to trade water.

Photo courtesy of USDI Bureau of Reclamation.

Clay canal liner in the Zurich Irrigation District reduces the amount of water lost to seepage.

Implementation of conveyance system efficiency improvements may have a high initial cost, but the longer term return would be to make more water available for crop production.

Using water conservation practices in the Milk River Basin may also have some potential impacts to the way the system is currently operated. It is generally believed that crops in the basin do not receive their full measure of irrigation water, making it unlikely that the crops' needs for full production are satisfied. An increase of conveyance system and on-farm efficiencies, providing more water to the crops' root zones, can increase the consumptive use of the currently available water supply.

Increased consumptive use of irrigation water will likely affect the return flow of water available for downstream water users. However, an increase of overall irrigation related efficiencies should lead to decreased demands at the canal head gates, meaning that more water will be left in the stream for longer sections of the river corridor. Furthermore, if water is managed to meet the crop needs in a uniform application on the fields, less deep percolation will occur. This means reduced quantities of pesticides and herbicides may leach into groundwater, eventually work their way to the river corridor, and affect the overall health of the stream and downstream water users.

Improved water supply, crop production, water quality and the general health of the Milk River and its residents are a few of the benefits to be had from water conservation. Once practiced, water conservation *is* a recipe for satisfying many needs.

Photo courtesy of USDI Bureau of Reclamation.

AgriMet weather station near Malta helps make efficient use of irrigation water by computing crop water use.

This chapter contributed by: Brent Esplin, Bureau of Reclamation.

Growing lawns in the Hi-Line's arid climate can be hard work. Luckily, a variety of best management practices (BMPs) can be used to help create and maintain attractive and healthy lawns.

Chapter 11

Managing Lawns

Mowing

Lawns along the Milk River are generally made up of a mixture of Kentucky bluegrass, and fescue. Some best management tips for mowing these grass mixtures follow.

- Mow at a height of two to three inches above the soil line. Mowing to this height helps to shade the soil and keep weeds from establishing. Mowed shorter, lawns become stressed and weak, and develop shallow root systems that may be unable to reach deeper water during drought.
- Always mow your lawn at the same height.
- No more than one third of the total plant height should be removed in one mowing.
- Maintain sharp blades on the mower. If dull blades are used, they can fray leaf tips, turning them brown.
- Begin mowing when the grass is three to four inches high. In high stress areas like shade and dry sunny slopes, however, grass should be mowed at longer heights.
- By allowing grass clippings to remain on the ground you help recycle nutrients and moisture, and cut down on fertilization needs.

Watering

Proper watering of the established lawn is important to its overall health. Lawns need about 1 inch of water per week. One inch of moisture penetrates 12 inches deep in sandy soil; 7 inches deep in loam, and 4 to 5 inches deep in clay. To measure the amount of water you are using, place an empty can (tuna and cat food cans work well) on the lawn while watering. Stop watering when the can is full or if you notice water running off the lawn. Early morning is the best time for watering to reduce evaporation and the potential for fungi related disease. To control where the water goes, water when it is not windy.

Keep lawns healthy and prevent them from browning during the hot months of July and August by watering deeply before the grass browns; mow using a higher cutting height; and use sharp mower blades. One deep watering is better than several light waterings. Deep watering encourages deeper, healthier root development, stores more nutrients with larger roots, and reduces evaporation loss.

Weed Control

The first step to weed control in lawns is to maintain a healthy lawn that is too competitive for most weeds. If you properly manage your lawn to encourage dense turf growth, the grass may crowd out weeds. Even with healthy lawns, however, broadleaf weeds like dandelions can still occur. To deal with these, properly identify the weed problem, select the correct herbicide, and follow directions on the label. Spray when the air is calm to prevent herbicide drift to vulnerable, desirable plants. The most effective time to apply chemical weed control is May, when weeds are growing rapidly. September is another good time to apply chemicals, preferably after a soaking rain. Avoid applying chemicals to broadleaf weeds in the high temperatures of July and August. Increasing your lawn mowing height can also help promote healthy grass and shade germinating weed seeds.

Best management practices (BMPs) combine several techniques to help promote healthy landscapes. When designing a new lawn, rejuvenating an old one, or simply improving your maintenance practices, consider the methods described above to develop trouble free lawns. And consult the list of reference sources for additional information on other essential BMPs for lawns—thatching, seedbed preparation, and fertilization.

Mowing at a height of 2 to 3 inches above the soil line helps maintain a healthy lawn.

References

MSU Extension Service:

Havre	(406)265-5481
Chinook	(406)357-3200
Malta	(406)654-2543
Glasgow	(406)228-8221 Ext. 41

http://extn.msu.montana.edu/

http://www.montana.edu/wwwpb/pubs/#Yard

NDSU Extension Service:

http://www.ext.nodak.edu/

http://www.ag.ndsu.nodak.edu/horticulture.htm

NRCS:

http://www.nrcs.usda.gov/feature/Backyard/

http://www.mt.nrcs.usda.gov/pas/forestry/constre2.html

This chapter contributed by: Lorna Philp, NRCS.

Dry cropland farming in the Milk River Watershed presents many challenges-from extreme heat to extreme cold; from floods to drought; insect outbreaks; and related economic instability. Given this, how does an agricultural producer make the most of their resources, sustain them, and make a living?

Managing Dryland Crops

Management of soil and water resources is the most critical element in dryland cropping systems. Most soils in the Milk River Watershed have a relatively high potential for production, but that potential is limited by available moisture.

In the early years of agricultural production, dryland farming practices centered on *strip cropping* and *grain/fallow rotations*. Strips helped control erosion and crop rotation helped store soil moisture and optimize crop production. Over time, agricultural production evolved to include reliance on improved equipment and crop varieties, better fertilizers, and pesticides for weed and insect control. During this evolution, several lessons were learned. If producers continually *clean tilled*, even though using strips, the soil could still erode away, and soil structure and organic matter be reduced. Continued use of a crop/fallow system increased saline seeps as moisture moved through soils with naturally occurring salts. We also learned that, if not carefully applied, fertilizers could end up in surface waterways and shallow groundwater. Pesticides thought to be safe sometimes ended up in groundwater, surface water, wildlife, or our food. These lessons have motivated many producers to become better stewards of their resources.

There are many benefits of using Best Management Practices (BMPs). Environmentally, erosion is reduced, nutrients and pesticides are applied more efficiently, and soil productivity and sustainability are improved. Economically, BMPs can help maintain or even improve land values. Socially, benefits to the local community may include reduced *nonpoint pollution*. Finally, voluntary producer use of BMPs can help minimize regulatory intervention.

The *Best Management Practices for Wheat* manual outlines six keys to profitable and environmentally sound wheat production. Although this manual emphasizes wheat production, the concepts can apply to dry cropland production in the watershed.

1. **Crop rotation.** Rotating crops, one of the most significant practices that can be applied, can interrupt weed and disease cycles and take advantage of available nutrients and stored soil moisture.
2. **Matching Inputs to Growth Stage.** A truly common-sense approach is maximizing the effectiveness and efficiency of high cost inputs like fertilizers and pesticides. Application too early or too late can lead to waste, pollution, or crop damage.
3. **Promote Root Health.** A strong, healthy root system more efficiently uses moisture and nutrients, increasing the potential for improved production.
4. **Break the Green Bridge.** Volunteer crops and grassy weeds can harbor insect and disease pathogens that can be transferred to the desired crop species. It helps to remove volunteer plants 2-3 weeks before planting the next crop.
5. **Match Inputs to Yield Goals.** Apply only what is needed, when needed. Increased applications of nutrients (fertilizers) above reasonable yield goals may lead to environmental problems and reduced return for the dollar spent.
6. **Use Certified Seed.** Using certified seed may increase yield potential due to better vigor, disease resistance, and an ability to compete with weeds. Inputs from pesticide or tillage may also be reduced.

Several useful publications, listed at right provide detailed guidelines for using additional BMPs that are appropriate for the Milk River Watershed. These include suggestions that are management specific (general crop management, nutrient and pest management) and BMPs that are conservation specific. Many of the practices can be used alone or in combination to accomplish an operator's goals.

Photo courtesy of USDA.

Combine augering wheat.

References

Dryland Saline Seeps: Types and Causes - http://www.agric.gov.ab.ca/agdex/500/1800012.html

Farm*A*Syst, Home*A*Syst - www.wisc.edu/farmasyst

National Association of Wheat Growers Foundation; *Best Management Practices for Wheat* - Technical Information for Crop Production (202)547-7800

NRCS; Field Office Technical Guide - Conservation Practice Technical Information

MSU Extension Service, Montguides (406)994-3273

Alternative Crops 8903AG, 8916AG, 8904AG, 8906AG, 8909AG, 8910AG, 9520AG, 9615AG;

Pesticide Management 8706AG, 8917AG, 8366AG;

Soil Compiling and Testing 8324AG, 8602AG, 8704AG;

Tillage 8305AG, 8328AG, 8344AG, 8346AG, 8350AG.

This chapter contributed by: Dale Krause, NRCS.

Livestock production is the major use of rangeland in the Milk River Watershed. As of January 1, 2000, there were 242,700 hundred cattle and 9,900 sheep in Valley, Phillips, Blaine, and Hill Counties. There were 2,377 farms in the same counties. How do livestock producers manage all of these animals and also care for the rangeland they require?*

Chapter 13

Managing Range & Riparian Reso

Commonly used strategies in the watershed are season long, deferred rotation, and rest rotation grazing. Season long grazing involves turning livestock into one pasture and letting them graze there for the entire season. Rotational grazing (deferred and rest) includes two or more pastures that the rancher moves his livestock into and out of, depending on vegetative conditions. The basic goal of any rotation system is to rest the vegetation during its growing season so that it can produce, store food and gain vigor. On average, the livestock are turned onto the range between April 15 and May 15 and taken off October 15 to November 15. This season of use is mainly on native range.

Some operations have introduced wheat grasses and wild ryes that are ready for grazing earlier than native plants. These introduced grasses are tolerant of drought, hardy and competitive. These pastures work with any grazing strategy and help to improve the overall condition of the native range.

Photo courtesy of USDA-NRCS

Sheep graze in a riparian pasture near Malta.

Best Management Practices

There are several things to consider when developing a grazing system, rotation, or plan.

(1) Decide what you want to accomplish. What is your objective? Goals vary from maximizing beef production to maximizing wildlife production. Have a clear objective and practice a grazing system that fits your situation.

(2) Take stock of your existing resources—dollars, time and labor, soils and vegetation, and livestock. Some grazing systems require lots of time and labor to successfully implement and maintain. Soils and vegetative information is needed to understand the condition of your rangeland. It also helps you to determine the number of livestock you can graze for a given time period and season without harming the resources; that is, the carrying capacity for sustained use of your land. There is no grazing system that can correct an over stocking situation.

(3) Provide a rest period during the *growing season* for vigorous plants that can survive the next harvest, be it grazing, browsing, fire, or insects. This gives plants time to use food stored in the root system and build above ground tissue for photosynthesis to produce more food. When the plant produces more food than it needs for above ground growth, the food will go towards root growth and storage.

How Much Time Will It Take?

Some grazing systems demand lots of time and labor to successfully implement and maintain. An example would be maintaining the entire added fence required for a multiple pasture rotation system.

It can be helpful to consider grazing management options by examining them more closely, one by one.

- **Season long grazing** does not provide for a rest period and is the least beneficial system for native grasses. A season long system needs to be moderately stocked (5 ac/aum or .2 au/ac) to have sustained use. This system works where water sources are unreliable or the topography is so rough that building or maintaining improvements is impossible or cost prohibitive.
- **Early season, deferred grazing** provides a rest period during April and May. This system works well in the Milk River Watershed as our staple, producing grasses are cool season. Pastures with crested wheatgrass and other introduced cool season grasses can be grazed early without harm, making them excellent for cattle grazing during the spring deferment period. Preferably, this system requires three pastures for alternating cattle use. Two pastures will work if one of them is an introduced, cool season pasture. The system may require some cross fencing and water development, but little compared to some systems.
- The classic **three pasture deferred grazing system** works well. The season of use is alternated between three pastures, so one out of three years the pastures have a spring rest period. The system requirements are similar to the early season, deferred grazing system.
- The **rest rotation** system provides for an entire season of rest. This system works well and is particularly beneficial to wildlife. The area rested provides critical habitat and cover for various wildlife species. The system requirements are similar to the previous two. However, because we will not be using some acres, the stocking may need to be adjusted down.
- Grazing systems using **four or more pastures** have the most management flexibility. However, they usually require a lot of fencing and water improvements to make them work. They are not suited for rougher country. These systems are also management intensive and there can be a lot of time spent moving livestock between pastures.

* Source: Agricultural Statistics Service

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Riparian Areas

Riparian pastures can be established in all of the grazing systems described above, except season long. In some cases the riparian pastures are scheduled for no use. This can happen and should happen if the area can not be used without harming the stream banks, stream bed, or associated vegetation. An important part of riparian areas is the amount of woody material. The big difference between grassland and 'woodies' is the woodies do not recover as rapidly from grazing or browsing.

Proper utilization of the range riparian areas presents a challenge to managers and is a major issue in the West. The reason is tied to water—water available in riparian areas and the lack of water elsewhere. Wet riparian areas attract animals for a drink, for shade, and for the abundant browse (new shrub growth) and forage (grass) there.

Problems occur when hooved animals are allowed season long access to riparian areas or when many livestock are forced to use the riparian water source. These situations impact the riparian area in two ways. One, the sod or soil holding resource is trampled and broken up by animal hooves. This makes the stream banks susceptible to erosion. Two, animals over browse the vegetation along the riparian area. Over use leads to less vigorous plants and smaller root masses. This means less soil holding capacity and, again, increased bank erosion.

Riparian areas can be damaged during any season. Early season use may damage soft banks and young woody vegetation. Summer use can cause livestock to spend a lot of time in the shade of the woodies, close to available water. Here they break off branches, trample young plants and rub away bark, if allowed to loaf too long. In the fall most of the grasses have cured and livestock can be hungry for protein. They may concentrate on the young, protein rich woody material in the riparian area to fulfill this need. Given this, you'll probably want to stock your livestock light to moderate (7 to 5 *ac/aum*) and alternate the season of use.

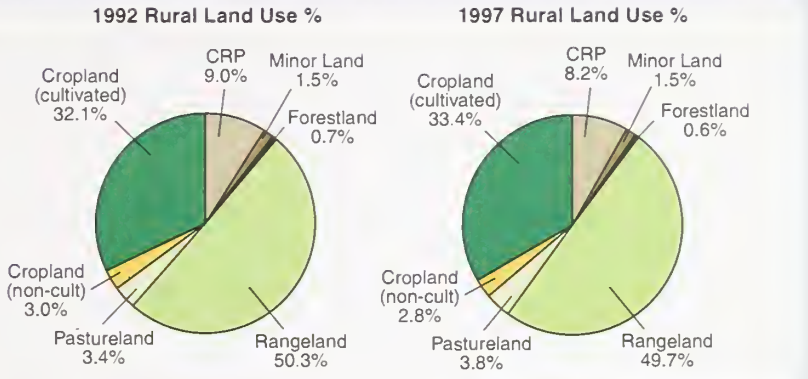
Proper use of the riparian areas is improving. It is being accomplished through livestock and range management that controls season of use, length of stay, and the development of other water sources away from the riparian zone.

Plants grazed continually during the growing season use all of their food to produce above ground tissue. With no food going to the roots, they begin to shrink. Water and mineral uptake lessens and if this continues long enough the plant will die.

Photos this page courtesy of USDA-NRCS.

Development of water sources, such as stock tanks, away from the riparian zone is helping to improve riparian resource management.

Trends in Rural Land Use for the Milk River Basin



Source: 1997 National Resources Inventory.

Information

Local US Department of Agriculture office, University Extension, and Bureau of Land Management offices.

US Fish & Wildlife Service
Wetland Management District
C/O Bowdoin NWR
HC 65, Box 5700
Malta, Montana 59538-9609
Telephone: (406)654-2863
FAX: (406)654-2866

References

Geologic Parent Materials of Montana Soils, Montana State University and USDA-Soil Conservation Service, Bulletin 721, 1980.

Chaney, Ed; Elmore, Wayne; Platts, William S. *Livestock Grazing On Western Riparian Areas.* EPA, 1990.

USGS Topographic Maps, Varying Dates

Web Pages:

www.mt.nrcs.usda.gov/nri/milk.html

www.nass.usda.gov/mt/county/livestock/00befcty.htm

www.nass.usda.gov/mt/county/profiles/1999/C99041.htm

<Dataweb.usbr.gov/html/milkrive.html>

www.r6.fws.gov/pfw/montana/mt3g.htm

This chapter contributed by: Dale Krause, NRCS.

Septic systems are designed to break down and neutralize contaminants before they enter groundwater or surface water systems. A properly designed, installed and maintained system is an essential link to protecting water quality in the Milk River Watershed.

Chapter 14

Maintaining Your Septic System

How Your Septic System Works

The typical septic system consists of: (1) a septic tank, which separates, stores, and begins to treat solid wastes, and (2) a drain field, or soil absorption system. The soil absorption system receives effluent from the septic tank and filters and treats it by natural biochemical means before it enters the groundwater.

Common Causes of Septic System Failure

Many things can interfere with the operation of your septic system, though by far the most important step you can take to prevent problems is to properly maintain it. Your system requires two things to operate efficiently:

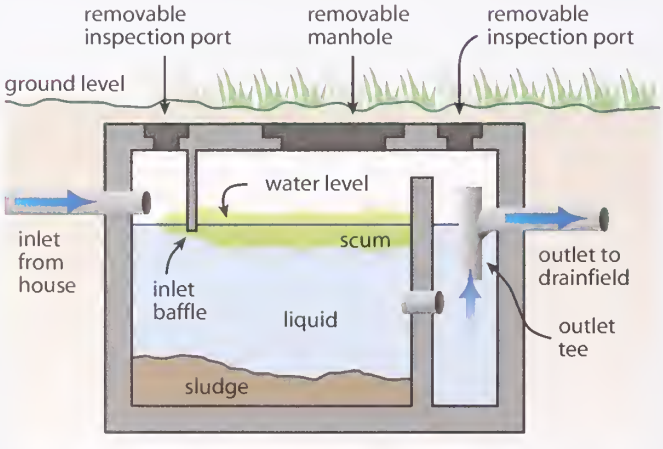
(1) Proper bacterial action—the system is designed to accept normal household waste that contains the organisms necessary to promote digestion. Bacteria-killing products such as paint thinner, chemical drain cleaners, some water-softening salts, paints, oils, acids, and pesticides will destroy or inhibit the ability of your septic system to break down household waste.

(2) Periodic pumping—sludge is the accumulation of solid material that cannot be further broken down by bacterial action and must be periodically pumped out. Failure to pump the system allows solids to overflow into the distribution system thereby clogging the drainfield. This not only can force a costly replacement of the system but may also result in sewage surfacing on the ground. While the frequency of pumping depends on the use of the system, the frequency of garbage disposal use, and the number of people using the system, generally a standard tank of 1,000-gallon capacity used by a family of four people should be pumped about every three years. Additives should not be added to your system to breakdown the sludge; you do not want solids in the drain field.

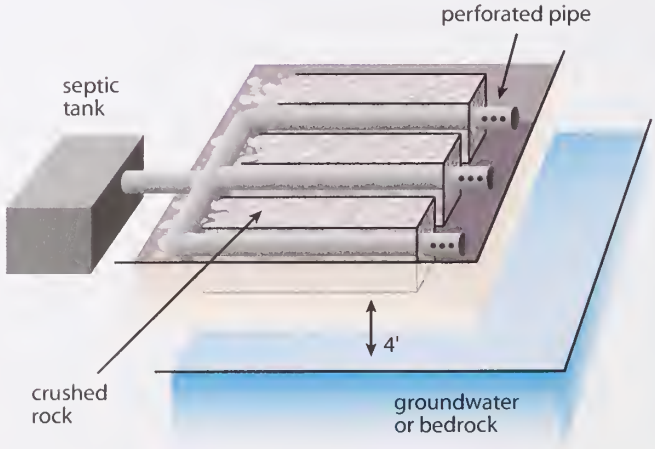
Several commercial septic pumping businesses operate in the Milk River Watershed.

Septic System Failure Can Also Result from:

- Overloading. Under sizing a drain field can cause the system to become water logged. Avoid putting too much water into the system at one time; wash clothes at off-peak times, for example, rather than when the shower or sinks are being used.
- Pouring decay-resistant materials into the system. Grease, sanitary napkins, and other solids will fill the tank faster than expected.
- Compacting the soil over the drainfield. Driving vehicles over the drainfield should be avoided.
- Age of the system. Septic systems are designed for an operational life of 10 to 30 years. If you have an aging system, it may be time to inspect and replace your system.



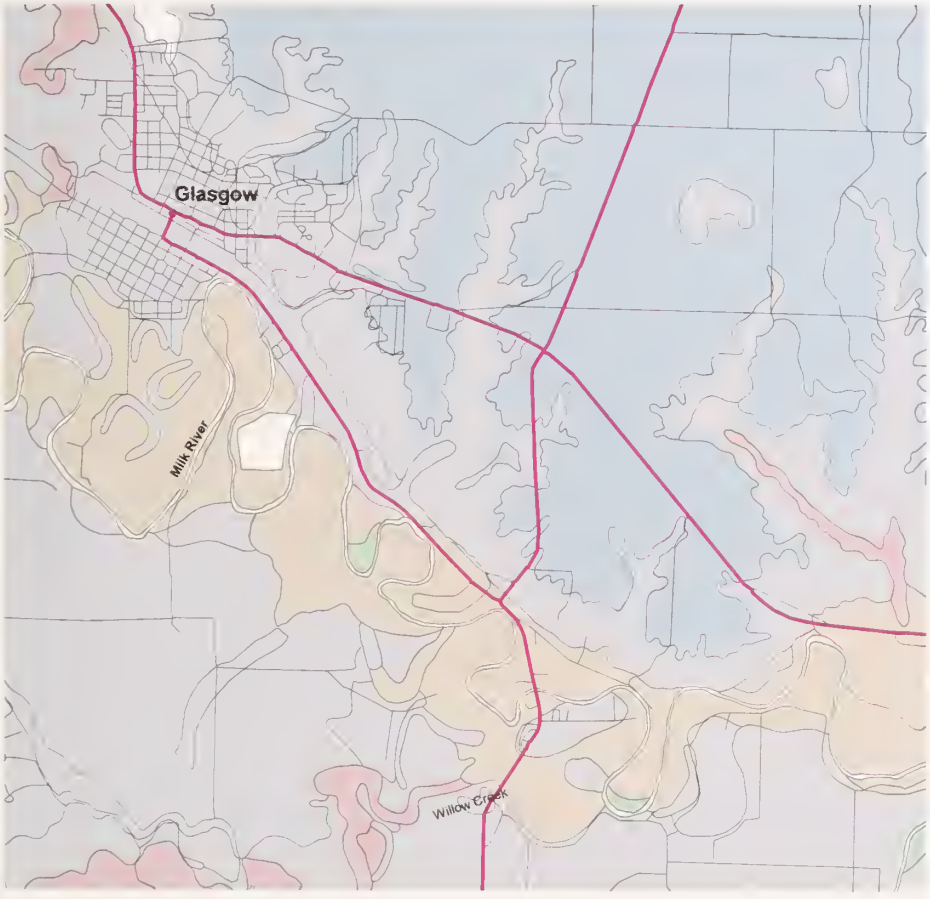
Parts of a septic tank.



Typical absorption field.

Siting Septic Systems/Permitting

A septic system depends on natural filtering and treatment, so soil is the most important component. Chemical processes and naturally occurring microbes in soil break down contaminants, while pathogens eventually perish in the inhospitable environment. Gravelly/sandy soils allow water to pass through to surface or groundwater too quickly before breakdown of contaminants is complete. Clay soils may impede the rate at which water is filtered. The Milk River Watershed has many areas of both clay and gravelly soils, meaning that septic system design is not a "one size fits all" proposition. The design of a system is based on soil and site characteristics, including depth to groundwater. Depending on where you live, soil and site characteristics may determine that a more sophisticated septic system is required. The design and sizing of any septic system in Blaine, Hill, Phillips and Valley Counties requires a permit from the County Sanitarian. Septic systems designs and construction are reviewed to insure that they are properly installed. State and county regulations require that all soil absorption systems be located at least 100 feet from the 100-year floodplain and 100 feet from any surface water, as well as being located at least 100 feet from any existing well or spring.



Colored areas show an example of general soil types based on water infiltration in the Milk River valley near Glasgow, Montana. The county sanitarian determines the appropriate system for your soil type after more detailed site analysis.

Highways
Roads
Cities

Soil Permeability (Inches/Hr.)
- 0.0-0.06
- 0.06-0.2
- 0.2-0.6
- 0.6-2.0
- 2.0-6.0
- Not Rated

Knowing When to Pump Your Tank

If you are unsure whether you need to pump, locate your access or inspection ports and determine the following:

- Scum is less than 3 inches from the bottom of the baffle or top of outlet tee.
- Sludge is less than 12 inches from the bottom of the outlet tee.
- If the sludge and scum together take up more than half of the tank.

Signs Your Septic System May Be Failing

- Slow draining water.
- Sewer backup in drains or toilets.
- Sluggish drains.
- Mushy ground or greener grass around septic system.
- Outdoor odors.
- Nitrates or bacteria in your drinking water.
- Algae blooms in ponds adjacent to your home.

Information

MSU Extension MONT Guides on Septic Systems (9401, 9403): (406)994-3451

MT DEQ – Design Standards for Septic Systems circular: (406)444-4969

Resources

NRCS – soil maps (406)357-2320

Blaine County Health Dept. (406)357-3310

Hill County Health Dept. (406)265-5481 ext. 268

Phillips County Health Dept. (406)654-2465

Valley County Health Dept. (406)228-8221 ext. 64

This chapter was adapted from The Gallatin Watershed Sourcebook.

Additional Information & Resources

Hi-Line Floodplain Contacts

Blaine County
Marty Dirden, Sanitarian
400 Ohio
Box 576
Chinook, MT 59523
Phone: (406)357-3310
Fax: (406)357-2199
E-mail: dirdenma@co.blaine.mt.us

Glacier County
Ron Andersen, Sanitarian
1210 East Main
Cut Bank, MT 59427
Phone: (406)873-4461
E-mail: randersen@myexcel.com

Hill County
Clay Vincent, Sanitarian/Health Planner
Hill County Courthouse
315 Fourth Street
Havre, Mt 59501
Phone: (406)265-5481, ext. 266
Fax: (406)265-5487
E-mail: Vincent@co.hill.mt.us

Liberty & Toole Counties
Darrel W. Stafford, DES Coordinator
303 E. Choteau
Shelby, MT 59474
Phone: (406)450-8972
Fax: (406)434-5890
E-mail: swmprat@mcn.net

Phillips County
Molly Carlson, County Sanitarian
Courthousse
PO Box 318
Malta, MT 59538
Phone: (406)654-2465
Fax: (406)654-2429
E-mail: mollycarlson2001@yahoo.com

Valley County
Cameron Shipp, County Sanitarian/
Planner
Valley County Courthouse
501 Court Square #11
Glasgow, MT 59230
Phone: (406)228-8221, ext. 64
Fax: (406)228-9027
Email: camshipp@hotmail.com

Hi-Line Irrigation Districts (Montana Only)

Alfalfa Valley	(406)265-8269
Dodson	(406)654-1634
Ft. Belknap	(406)353-3509
Glasgow	(406)228-2346
Harlem	(406)353-2583
Malta	(406)654-1440
Paradise Valley	(406)265-8269
Zurich	(406)357-4105

Milk River Joint Board of Control
(406)654-1440

Federal Agencies

Bureau of Indian Affairs

Blackfeet Agency
Bureau of Indian Affairs
Box 880
Browning, MT 59417
Phone: (406)338-7544
Fax: (406)338-7761

Fort Belknap Agency
Bureau of Indian Affairs
P.O. Box 98
Harlem, MT 59526
Phone: (406)353-2901
Fax: (406)353-2886

Rocky Boy's Agency Representative
Bureau of Indian Affairs
Box Elder, MT 59521
Phone: (406)395-4476
Fax: (406)395-4382

Bureau of Land Management

Glasgow Field Station
RR 1-4775
Glasgow, MT 59230-9796
Phone: (406)228-3750
Fax: (406)228-4121
E-mail: MT_Glasgow_FS@blm.gov

Havre Field Station
1704 Second Street West, Drawer 911
Havre, MT 59501-0911
Phone:(406)265-5891
Fax: (406)265-3634
E-mail: MT_Havre_FS@blm.gov

Bureau of Reclamation
PO Box 30137
Billings MT 59107-0137
Phone (406)247-7295
Fax (406)247-7338

US Geological Survey
District Office
USGS
3162 Bozeman Avenue
Helena, MT 59601
(406)457-5900
http://montana.usgs.gov/

USDA Natural Resources Conservation Service
Federal Building, Room 443
10 East Babcock Street
Bozeman, MT 59715-4704
Phone: (406)587-6813
FAX: (406)587-6761

(Natural Resource Conservation Service Field Offices provide services through County Conservation Districts. See Conservation Districts below.)

US Fish & Wildlife Service
Bowdoin National Wildlife Refuge
HC 65, Box 5700
Malta, MT 59538
Phone: (406)654-2863
E-mail: Bowdoin@fws.gov

State Agencies

Montana Department of Environmental Quality

Montana Dept of Environmental Quality
1520 E. Sixth Avenue
Helena, Montana 59620

Source Water Protection Program
(406)444-4806

Water Protection Bureau (406)444-0916

Montana Department of Fish, Wildlife & Parks

STATE HEADQUARTERS
1420 East Sixth Avenue
P.O. BOX 200701
Helena, MT 59620-0701
Phone: (406)444-2535
Fax: (406)444-4952

REGION 6
Havre Area Resource Office
2165 Hwy 2 East
Havre, MT 59501
(406)265-6177
Fax: (406)265-6123

Glasgow Area Resource Office
Route 1-4210
Glasgow, MT 59230
(406)228-3700
Fax: (406)228-8161
fwprg62@state.mt.us

Montana Department of Natural Resources and Conservation

Havre Water Resources Regional Office
210 Sixth Avenue
PO Box 1828
Havre, MT 59501-1828
(406)265-5516

Glasgow Water Resources Regional Office
222 Sixth Street South
PO Box 1269
Glasgow, MT 59230-1269
(406)228-2561

MONTANA DNRC-TRUST LANDS
Havre Unit Office
210 Sixth Avenue
PO Box 868
Havre, MT 59501-0868
(406)265-5236

Glasgow Unit Office
224 Sixth Street South
PO Box 1007
Glasgow, MT 59230-1007
(406)228-2430

International Agency

International Joint Commission

United States Section
1250 23rd Street, NW
Suite 100
Washington, D.C. 20440
Phone: (202)736-9000
Fax: (202)735-9015

Canadian Section
234 Laurier Ave. West
22th Floor
Ottawa, ON K1P 6K6
Phone: (613)995-2984
Fax: (613)993-5583

Local Contacts

County Conservation Districts

Blaine County Conservation District
230 Ohio Street
P.O. Box 189
Chinook, MT 59523-0189
Telephone: (406)357-2320
FAX: (406)357-3597

Glacier County Conservation District
601 W. Main Street, Suite 14
Northern Village Shopping Center
Cut Bank, MT 59427-3082
Telephone: (406)873-4292
FAX: (406)873-3473

Hill County Conservation District
206 25th Avenue West
Havre, MT 59501-3418
Telephone: (406)265-6792
FAX: (406)265-3077

Liberty County Conservation District
18 Main Street
P.O. Box 669
Chester, MT 59522-0669
Telephone: (406)759-5778
FAX: (406)759-5791

Phillips Conservation District
U.S. Highway 191 South
HC 72, Box 7615
Malta, MT 59538-9407
Telephone: (406)654-1334
FAX: (406)654-1691

Toole County Conservation District
1125 Oilfield Avenue
P.O. Box 919
Shelby, MT 59474-0919
Telephone: (406)434-5234
FAX: (406)434-2718

Valley County Conservation District
54062 U.S. Highway 2 West, Suite 2
Glasgow, MT 59230-2838
Telephone: (406)228-4321
FAX: (406)228-8101

Local MSU Extension Offices
(See page 34.)

Milk River International Alliance
Blaine County Conservation District
Telephone: (406)357-2320, ext. 101
E-mail: ssattleen@mt.usda.gov

Tribal Contacts

Blackfeet Tribal Headquarters
P.O. Box 850
Browning, MT 59417-0850
Telephone: (406)338-3153
Fax: (406)338-3529

Ft. Belknap Community Council
RR1, Box 66
Harlem, MT 59526
Phone: (406)353-2205
Fax: (406)353-2797

Ft. Peck Tribal Executive Board
P.O. Box 1027
Poplar, MT 59255
Phone: (406)768-5155
Fax: (406)768-5478

Chippewa Cree Tribal Council
(Rocky Boy's)
RR1, Box 544
Box Elder, MT 59521
Phone: (406)395-4282
Fax: (406)395-4497

A Web Site Sampling

US Bureau of Reclamation AgriMet Information: http://www.gp.usbr.gov/agrimet/agrimet.htm

MSU Extension Agronomy Notes: http://scarab.msu.montana.edu/agnotes/

Cleaner Water through Conservation: http://www.epa.gov/water/you/intro.html

Water Wiser Drip Calculator *(Measure and Estimate Water Wasted Due to Leaks)* http://www.waterwiser.org

H20 House: Water Saver Home: http://www.h2ouse.org/

Cleaner Water through Conservation: http://www.epa.gov/water/you/intro.html

The Year of Clean Water (2002): http://www.yearofcleanwater.org/

Glossary

Acres/animal unit per month (ac/aum) – The acreage needed to support 1 bull or 1 cow/calf pair for one month.

Acre-foot – The volume of water that will cover one acre to a depth of one foot. An acre-foot equals 325,851 gallons, or 43,560 cubic feet. A flow of 1 cubic feet per second produces 1.98 acre-feet per day.

Adjudication – Judicial procedure decreeing the quantity and priority date of all existing water rights in a basin.

Alluvium –Deposits of clay, silt, sand, gravel, or other particulate material that have been deposited by a stream or other body of running water in a streambed, on a flood plain, on a delta, or at the base of a mountain.

Animal units/acre – The number of animals that could be sustained on one acre. An animal unit is equivalent to 1 bull or 1 cow/calf pair.

Appropriator – A person who takes water from a watercourse and puts it to beneficial use.

Appropriation Doctrine – The system for allocating water to private individuals that is used in most Western states. Commonly used throughout the arid west as early settlers and miners began to develop the land. Based on the concept of "First in Time, First in Right." The first person to take a quantity of water and put it to beneficial use has a priority right of use over a subsequent user. Under drought conditions, senior (higher priority) users are satisfied before junior users receive water.

Appurtenant – (Water-related) a right to water that is attached to or associated with the ownership or possession of the land.

Aquifer – A geologic formation that is water bearing, that stores and/or transmits water, such as to wells and springs.

Badlands – A term used to describe a semi-arid landscape that has eroded heavily by water and/or wind. Characterized by deep ravines and gullies, sharp ridges, and a generally barren surface.

Basin – The area drained by a river and its tributaries; a watershed.

Bedrock – Rock at or near the Earth's surface that is solid and relatively unweathered.

Beneficial use – The use of water for the benefit of the appropriator, other persons, or the public, as defined in state law. It may include (but is not limited to) water used for agriculture (including stockwater), domestic, fish and wildlife, industrial, mining, municipal, power and recreational uses.

Clean tilled – The cropland management practice of burying a majority of the residue from the previous crop through mechanical tillage within the plow layer. Little to no residue is left on the surface for erosion control.

Compact – A legal agreement between sovereigns. For example, an agreement between Montana and other states; or Montana and Indian Tribes and their trustee, the Federal Government; or between Montana and a federal agency such as the National Park Service.

Confluence –The stream or body of water formed by the junction of two or more streams or rivers.

Conglomerates – Coarse grained sedimentary rock composed of rounded rock fragments cemented in a mixture of clay and silt.

Conservation – Water saving methods that serve to increase water supplies by decreasing demands for water.

Consumptive use – That part of water withdrawn that is evaporated, transpired by plants, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment.

Constituents – The term commonly used to describe the substances that can contribute to water quality degradation. Synonyms might be 'pollutants,' 'parts,' 'components,' 'substances.'

Conventional treatment – Water treatment processes which consists of rapid mix, flocculation, sedimentation, filtration and chlorination.

Conveyance loss – Water that is lost in transit from a pipe, canal, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a ground-water source and be available for further use.

Crop Rotation – A pattern of changing the crops grown in a specific field from year to year in order to control pests and maintain soil fertility.

Cropland – Land currently tilled, including cropland harvested, land on which crops have failed, summer fallowed land, idle cropland, cropland planted in cover crops or soil improvement crops not harvested or pastured, rotation pasture, and cropland being prepared for crops, or newly seeded cropland.

Decreed water rights – A water right issued by the court upon adjudication of a stream.

Domestic water use – Water used for household purposes, such as drinking, food preparation, bathing, washing clothes, dishes, and dogs, flushing toilets, and watering lawns and gardens.

Drainage – The land area from which water drains into a river; also called a watershed or river basin.

Erosion – The process in which a material is worn away by a stream of liquid (water) or air, often due to the presence of abrasive particles in the stream.

Flood – An overflow of water onto lands that are used or usable by man and not normally covered by water. Floods have two essential characteristics: the inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake, or ocean.

Flood, 100-year – A 100-year flood does not refer to a flood that occurs once every 100 years, but to a flood level with a 1 percent chance of being equaled or exceeded in any given year.

Floodplain – The strip of relatively flat and normally dry land alongside a stream, river, or lake that is covered by water during a flood.

Flow rate – The rate at which water is diverted from a source.

Forbs – Any Herbaceous flowering plant other than a grass; especially one growing under range conditions.

Fresno – Earth-moving scraper developed by James Porteous around 1880 for farmers developing irrigation canals in the Fresno Valley, California. Porteus' C-shaped scraper had a blade along the bottom and it scooped dirt as it was pulled along. Porteous called it the "Fresno Scraper." It was used all over the world, including the Milk River Valley.

Geomorphology – That branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place in the evolution of land forms.

Glacial outwash plains – A flat or gentle sloping surface of sediments deposited by meltwater streams at the edge of a glacier.

Glacial till – Mixed sediments deposited directly by a glacier.

Gradient – The steepness of a slope as measured in degrees, percentage, or as a distance/ratio.

Grain/fallow rotations – A cropland management sequence using small grains and fallow in rotation. Examples include rotations such as spring wheat/ fallow, or spring wheat/barley/fallow.

Glacier – A huge mass of ice, formed on land by the compaction and recrystallization of snow that moves very slowly downslope or outward due to its own weight.

Ground water – Water stored underground in porous geologic materials (soil, rock crevices, etc.) that make up the Earth's crust.

Growing season – Time of greatest plant growth. April - June for cool season and May - September for warm season vegetation.

Habitat –The place where organisms live.

Habitat loss –The loss of natural habitat.

Hardness – A water-quality indication of the concentration of alkaline salts in water, mainly calcium and magnesium. If the water you use is "hard" then more soap, detergent or shampoo is necessary to raise a lather.

Headwater(s) – The source and upper reaches of a river or stream. Can refer to the water upstream from a structure or point on a stream. Also may be thought of as any and all parts of a river basin except the mainstream river and main tributaries.

Hydrograph – A record showing the changes in flow of a river over time.

Hydrologic cycle – The circulation of water from the sea, through the atmosphere, to the land and then back by overland and underground routes or directly back into the atmosphere by evaporation and transpiration.

Incised channel – A stream or river channel that cuts through the bed of the valley floor, in contrast to one flowing on a floodplain. A channel formed by the process of degradation.

Interbasin – Between one river basin (watershed) and another. For example, an interbasin transfer is the physical transport of water from one watershed to another.

Instream flow – The water left in a stream to maintain the existing aquatic resources and associated wildlife and riparian habitat and for water quality dilution.

Irrigation – The controlled application of water for agricultural purposes through manmade systems to supply water requirements not satisfied by rainfall.

Irrigation District – A subdivision of government, managed by a board of directors, that supplies water to irrigators within a specified region.

Irrigation season – Defined as April 1 through October 31 in the Boundary Waters Treaty of 1909.

Island mountain range – A row of mountain peaks that is isolated from other mountain ranges by considerable distances. In the Milk River Watershed, the Bears Paw Mountains are an example.

Mainstem – The main course of a river or stream system formed by the smaller tributaries that flow into it.

Migratory spawners – Fish that live in one area of a river or lake for most of their life history, then migrate, or move, to another location, typically upstream to tributaries, to spawn and fulfill the reproductive function of their life history.

Nonpoint (source) pollution – Pollution discharged over a wide land area, not from one specific location. Forms of diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land-use activities, which are carried to lakes and streams by surface runoff. Contamination that occurs when rainwater, snowmelt, or irrigation washes off plowed fields, city streets, or suburban backyards, moves across the land surface, and picks up soil particles and pollutants, such as nutrients and pesticides.

Non-salmonid – Any fish that is not a trout or salmon.

Oxbow – An abandoned meander in a river or stream, caused by neck cutoff. Used to describe the U-shaped bend in the river or the land within such a bend of a river.

Peak flow – The maximum instantaneous discharge of a stream or river at a given location. It usually occurs at or near the time of maximum stage.

Permit – An authorization to use water, issued by the state, specifying conditions like source of supply, point of diversion, type of use, quantity, time and location of use.

Point source pollution – Water pollution coming from a single point or pipe, such as a sewage-outflow pipe.

Potable water – Water of a quality suitable for drinking.

Pothole (prairie) – A geologic and geographic formation in the Northern Great Plains region of the United States stretching into Canada. Characterized by a depression in the land formed thousands of years ago as a result of retreating glaciers during the last Ice Age. A vast region of seasonal wetlands accommodating extensive bird populations during their migration and breeding seasons.

Glossary (continued)

Priority date –The official date of a water right appropriation, generally the date of established intent; used in determining seniority among water users.

Quantify – To determine the volume of a water right, typically expressed in acre-feet and/or flow rate.

Recharge – The addition of water to an aquifer by natural infiltration or by artificial injection through wells.

Reservoir – Pond, lake, or basin, either natural or artificial, for the storage, regulation, and control of water.

Riparian – An area bordering a water body.

Riparian rights – The water rights of landowners adjacent to rivers and streams.

Rocky Mountain Uplift – Evidence indicates that the Rocky Mountains were formed from the uplifting movement of the earth's surface, which occurred as a series of pulses over millions of years.

Saline seeps – Wet areas in non-irrigated soils where soluble salts accumulate from the evaporation of the seeping water and crop or grass production is reduced or eliminated.

Saline water – Water that contains significant amounts of dissolved solids. EPA parameters for saline water:

- Fresh water - Less than 1,000 parts per million (ppm)
- Slightly saline water - From 1,000 ppm to 3,000 ppm
- Moderately saline water - From 3,000 ppm to 10,000 ppm
- Highly saline water - From 10,000 ppm to 35,000 ppm

Sedimentary rock – Rock formed of sediment, and specifically: (1) sandstone and shale, formed of fragments of other rock transported from their sources and deposited in water; and (2) rocks formed by or from secretions of organisms, such as most limestone. Many sedimentary rocks show distinct layering, which is the result of different types of sediment being deposited in succession.

Slough – A wet or marshy place. Also a side channel or inlet as from a river; ordinarily found on or at the edge of the flood plain or a river.

Species composition – The different species and proportions in which they are found that live together and collectively make up the community (in this case the Milk River fishery).

Strip cropping – A land management practice where a block of land is divided in to smaller strips, usually perpendicular to the prevailing wind, for erosion control. The strips are generally alternated between grain crops and fallow.

Surface water – Water above the land surface, including lakes, rivers, streams, wetlands, wastewater, flood water, and ponds.

Tectonics – A theory suggesting that the Earth's surface is composed of a number of oceanic and continental plates. Known as plate tectonics, it holds that these plates are driven by convection currents in the earth's mantle, and slowly move. Helps to explain the occurrence and formation of mountains, folds, faults, volcanoes, earthquakes, ocean trenches, and the mid-oceanic ridges.

Tributary – A smaller river or stream that flows into a larger river or stream. Usually, a number of smaller tributaries merge to form a river.

Tumble bug scrapers – An earth moving scraper pulled by horses and similar to a fresno.

Turbidity – The amount of solid particles that are suspended in water and that cause light rays shining through the water to scatter. Turbidity makes the water cloudy or even opaque in extreme cases.

Velocity (of water in a stream) – Rate of motion of a stream measured in terms of the distance its water travels in a unit of time, usually expressed in feet per second.

Watercourse – A stream or river of water flowing in a channel with well defined banks.

Water right – A legal right to divert state waters for a beneficial purpose.

Water quality standards – Laws or regulations, promulgated under Section 303 of the Federal Clean Water Act. Consist of the designated use or uses of a water body or a segment of a water body and the water quality criteria that are necessary to protect the use or uses of that particular water body. Every state is required to develop water quality criteria standards for the waterbodies within the state and revise them every 3 years.

Watershed – The land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large watersheds, like the Mississippi River basin contain thousands of smaller watersheds.

Wastewater – Water used in homes, industries, and businesses that is not for reuse unless it is treated.

Wastewater treatment plant – A facility designed to receive the wastewater from domestic sources and to remove materials that damage water quality and threaten public health and safety when discharged into receiving streams or bodies of water. The substances removed are classified into four basic areas:

(1) greases and fats;

(2) solids from human waste and other sources;

(3) dissolved pollutants from human waste and decomposition products; and

(4) dangerous microorganisms.

Most facilities employ a combination of mechanical removal steps and bacterial decomposition to achieve the desired results. Chlorine is often added to discharges from the plants to reduce the danger of spreading disease by the release of pathogenic bacteria.

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